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INDEX TO CONTENTS, PAGE 113. . . . . ADVERTISERS' INDEX, PAGE 22.

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CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

*Automatic and Distance Lighters, by Francis H. Gilpin..... 113

Report of Committee (American Gas Institute) on Power Economies in Gas Plants..... 119

EDITORIALS—

Forty-fourth Meeting, New England Association of Gas Engineers—[Special Editorial Correspondence]..... 120

Action taken by the Guild of Gas Managers, Respecting the Late Mr. Charles Florence Prichard..... 121

Briefly Told..... 121

In Memoriam—Charles F. Prichard: Society of Gas Lighting—Joint Meeting, Illuminating Engineering Society and Municipal Art Society of New York.

Extinguishing Fires in Volatile Liquids, by Mr. Frederic Egner.... 125

NEW METHODS AND APPLIANCES..... 125

*Stamped Charges for Verticals—Gas for Ballooning—*Ornamental Post used in Memphis, Tenn.—Sun Power Plant—Safety Device for Calorimeters.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 126

Promotion for Mr. W. D. Clifford—Annual Meeting, New Haven (Conn.) Company—Annual Meeting, Salem, Mass.—Good Work, Georgetown, D. C.—No Opposition Works for Mason City, Ia.—Proposed Gas Plant for Rio Vista, Cal.—Again the Wilson (N. C.) Gas Project—Accident Prevention, Swarthmore College—Annual Meeting, Washington, D. C.—Mr. Atwood is "Surprised"—Something from Phoenix, Ariz.—Good Work, the Byllesby Subsidiaries—Gas for South Covington, Ky.—Untramelled, Perhaps—Proposed Plant for Chester, S. C.—A Correction—And Other Items.

UTILITIES COMMISSION NEWS..... 128

Pennsylvania Appointments—Illinois Officials—Threaten Municipal Plant—To Regulate Municipal Plants—Specified Accounts for Municipal Plant.

The Market for Gas Securities..... 128

Public Lighting Table for March, 1914 (Advertising Section)..... 10

Meeting Times of the Various Gas Associations " ... 27

Automatic and Distance Lighters.[1]

[Written for the Eighth Annual Meeting, American Gas Institute, by FRANCIS H. GILPIN.]

The problem of ignition of gas lamps is an old one. With the advent of electricity and its convenience of control by a switch the need for a distance and automatic control of ignition for gas has become almost a necessity. The earliest attempts at auto-ignition inclined towards a substance that of its own properties would cause ignition of the flame, such as platinum black; but, owing to the deterioration of such substances, either by evaporation, fusion, or moisture absorption, results have not been entirely satisfactory. The introduction of the incandescent mantle burner and the by-pass cock and pilot, gave the first directional impulse toward a satisfactory solution. The field of distance or automatic ignition is divided into two great classes—indoor, and outdoor or street lighting. The first class is controlled by the consumer and restricted to single units or small groups of lamps at a relatively short distance, while in the latter the control is over a wide area through the distribution system of the manufacturer.

The first attempt at outdoor distance lighting was in 1850, at Göttingen, but does not appear to have been successful. Since 1878 the problem has been more generally attempted and in some cases with very satisfactory results. Numerous means have been adopted to reach the desired end:

(1) Pyrophoric.
(2) Catalytic.
(3) Electric.
(4) Pneumatic.
(5) Pressure-wave.
(6) Pressure-wave and clockwork.
(7) Clockwork.

The jump spark system of ignition might also be mentioned, where the lamp-igniters are electric spark gaps in series with a high potential coil.

Indoor Lighting.

For this service the pneumatic, catalytic, electric, pyrophoric and modified forms of pressure apparatus are most satisfactory. Below are described a few of the systems that have been tested at the Photometrical Laboratory. Most of the appliances were in regular service and not operated under laboratory conditions, and from the troubles experienced are summarized the good and bad features.

Pyrophoric Lighters depend on the ignition of the gas by sparks from the friction between a pyrophoric alloy and an abraiding surface such as a small file. One is shown attached to an inverted lamp in Fig. 1. A circular file turned across a pellet of cerium-iron alloy,

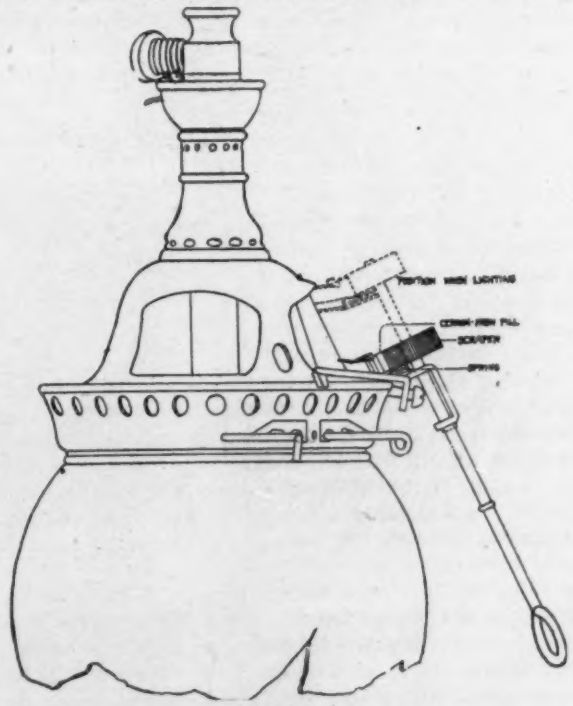


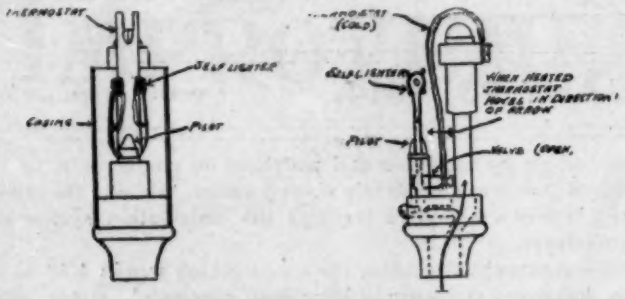
Fig. 1.

makes the sparks which fall into the crown vents of the burner and ignite the gas. When not in use the device is out of the direct path of the heated products. In a variation of this apparatus the upward motion of the arm carrying the file opens the burner cock. It is claimed that 4.6 grains of alloy will produce 8,000 sparks.

1. Slightly abridged.—EDS.

Catalytic devices depend on the heating of a fine platinum (or similar metal) wire by the gas itself after the temperature has been sufficiently raised by platinum black or electric current to start the catalytic action of the gas.

The D'Arsi Auto-Flame Gas Lighter is similar to the ordinary open-flame by-pass burner with small pilot flame, the pilot way being open when the burner is cold. On opening the gas cock the pilot is ignited by platinum black pellets in connection with small platinum wires. The main burner, when ignited from the pilot flame, heats a thermostat which pushes a small piston valve horizontally into the pilot gas way, closing it.



D'ARSI AUTO FLAME GAS LIGHTER.

Fig. 2.

Lyon's Hot-Wire Igniter is shown in Fig. 3. It consists of a

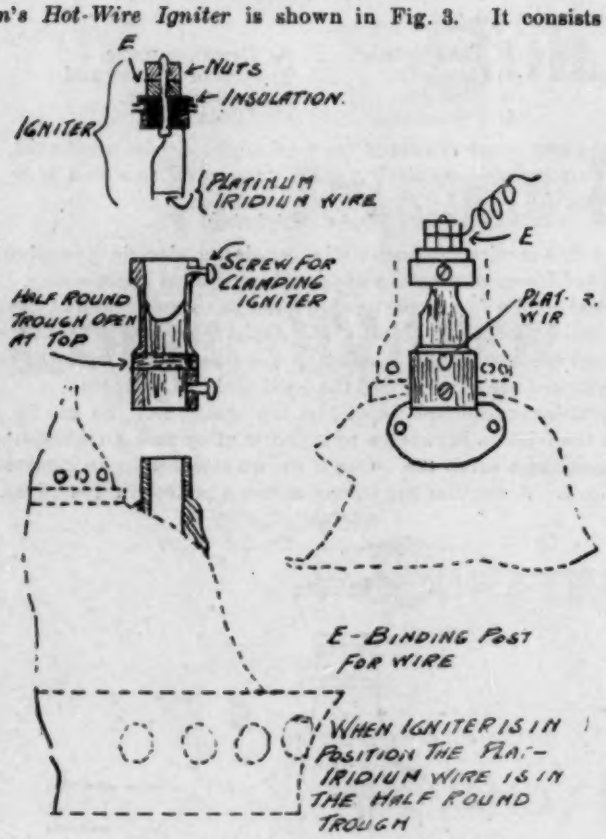


Fig. 3.

small spiral of platinum wire 0.002 inch in diameter, in a special attachment to the burner, heated electrically to 500° F. The filament is protected from direct impingment of the gas by a trough, but sufficient gas, diluted with air, strikes it to raise its temperature by catalytic actier. to the kindling point (1,500° F), at which point the gas ignites. This apparatus is used in connection with a self contained fixture, having a 1.5 volt dry cell in the casing at the base of the drop.

The Telephos Igniter is shown in Fig. 4, and can be used for either unright or inverted lights. The lighting device is similar to the Lyon, in that a fine wire is heated by an electric current and by catalytic action. In series with the igniter the current actuates an electric magnet turning a flat rachet disc valve, alternately opening and closing the gas passage. In the upright type the igniter is in the top of the burner cap inside the mantle, and in the inverted it is attached to a pilot jet. A small conical valve is raised, opening the pilot tube, by an inclined wire passed through an eyelet in the top of the valve when the armature is drawn towards the magnet by the current.

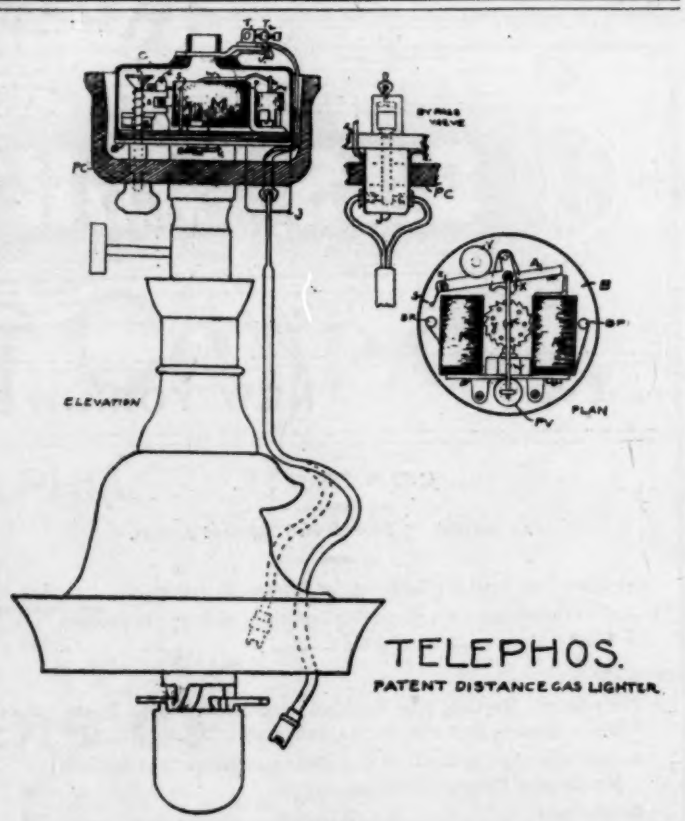


Fig. 4.

The inverted type is protected from the exhaust products by a porcelain enclosing cup. The apparatus is operated by an externally located 6 volt, special type cell and single push button.

The Magnetic Electric Cock is operated with a by-pass integral with it. Two electro-magnets are connected in parallel, using the gas pipe for a return, and are operated by separate push buttons. The cock barrel is rocked back and forth through 90° by the alternate strokes of the armatures of the two electro-magnets on a cam attatched to the barrel. It is operated by three No. 6 Columbia dry cells in series.

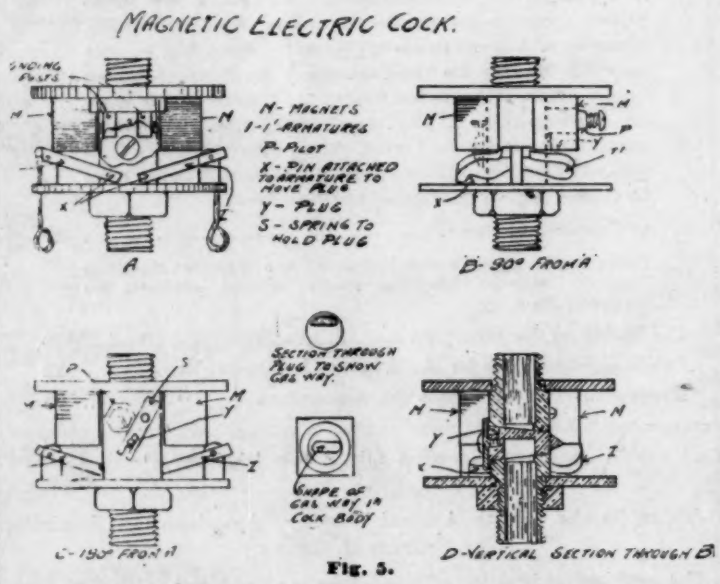


Fig. 5.

The Positive Pneumatic Valve consists of a small horizontal piston valve across the gas way, operated by the suction of a small plunger pump through a length of hollow brass tube about 0.08 inch outside diameter.

The Luther Pneumatic Valve is shown in Fig. 7. The valve proper consists of two plungers connected axially by a rod, operated by vacuum or pressure. The rod carries a rack which turns a pinion on the valve stem. A helical slot in the pinion moving over a fixed pin gives it an axial motion that on alternate strokes unseats and seats the valve.

The Askania (pressure lighter) consists of a regulator and an operator. The regulator may be placed anywhere in the gas supply line and looks like an electric snap switch. By turning the switch to the

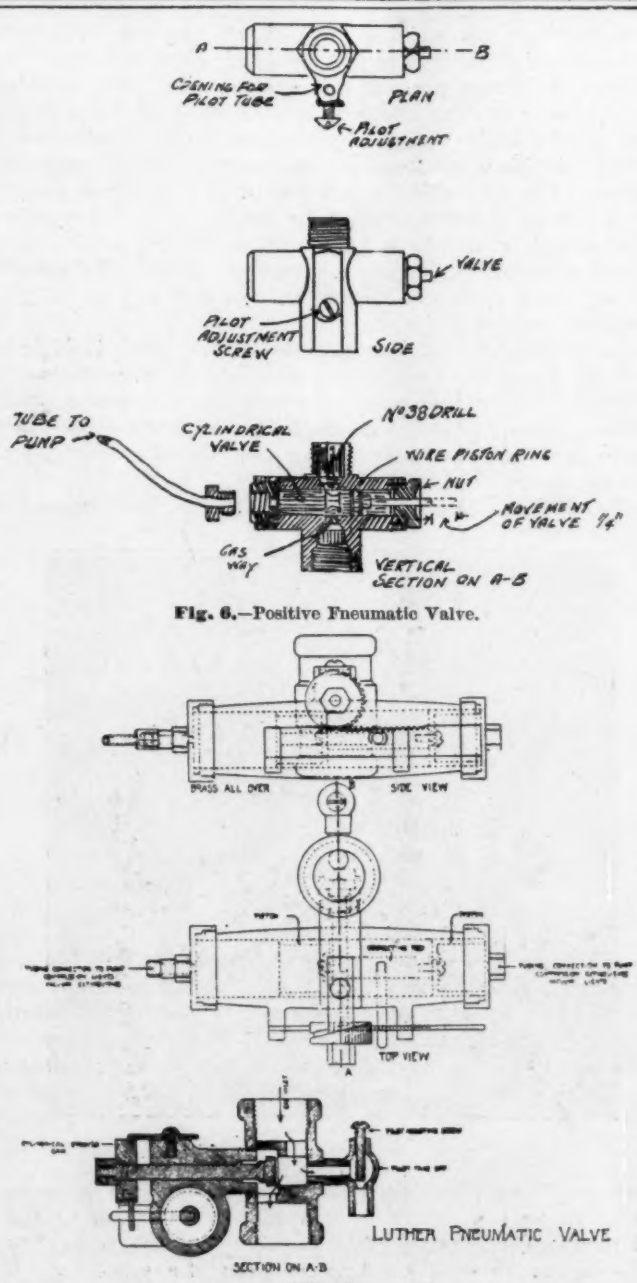


Fig. 6.—Positive Pneumatic Valve.

Fig. 7.

left, full line pressure is admitted to the burner; if turned to the right a reduced pressure is maintained, regulated by a screw in a small gas passage. The operator is placed in the line directly over the lamp. When the by-pass in the regulator is open the small float and ball are in the lowest position, the ball closing the main gasway and the pilot being lighted. When the switch is turned "on" the increase of pressure causes the float to rise, opening the main gasway and shutting off the pilot. The float rises when the pressure exceeds $\frac{3}{4}$-inch water.

Outdoor Lighting.—Outdoor lighting consists mainly of street and park lighting under the direct supervision of the supplying company as to time of lighting and extinguishing; but individual lamps operated by the consumer can be handled similarly to advantage. For the last the magnetic cock described for indoor use can be used, though its application is limited.

The present system of lighting each street lamp by hand is not satisfactory. The number of men necessary to cover a wide area increases labor cost and the necessity for beginning to light 1 hour before lighting time and the reverse at extinguishing time mean waste of gas.

An automatic distance lighter should have the following characteristics: It should be proof against unintentional derangement; all parts easily replaceable; construction and manipulation so simple as not to require skilled labor; can be installed by a fitter not specially trained, readily adjusted to operate at any pressure, and, when set, must remain unaffected by outside influence; in case of failure to operate, readily lighted by hand; it should be small, both for artistic and light economy reasons; not readily obstructed by

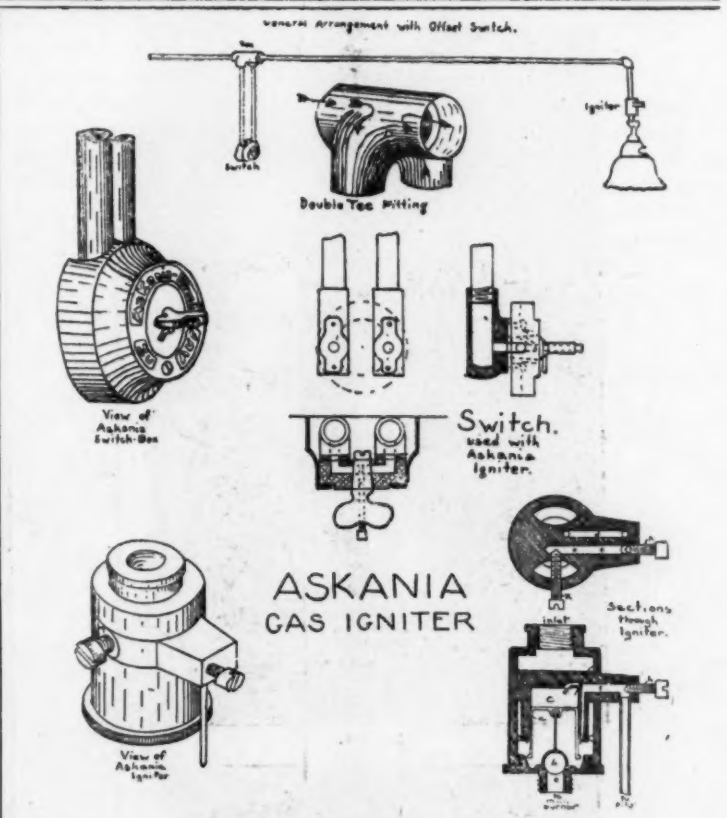


Fig. 8.

naphthaline and, if obstructed, easily cleaned; and, finally, in a short time it should repay the cost of installation by saving in wages and gas consumption.

In the present state of the art those of the clockwork or pressure-wave systems, or combination of the two, are most adaptable, because those operated electrically or pneumatically cost too much. Several of each type have been investigated as below described.

The method of test is as follows:

When the lighter is received it is thoroughly examined and its method of operation determined by trial indoors. The system determined, it is set on a lamp post, of which there are sets of six on 2 independent lines outside the laboratory. These lines are controlled by independent governors, though both may be operated in parallel on either governor.

Clockwork Systems.

The Horstmann apparatus is shown in Fig. 9. The plug cock is outside the case containing the clockwork and is operated by a lever and connecting rod from a train of clockwork separate from the timing works. Pins on the main clock dial release this secondary clockwork, which automatically shuts off when a disc carrying the operating pin has made one-half revolution. This pin shifts horizontally the rod moving the clockwork lever one-quarter revolution.

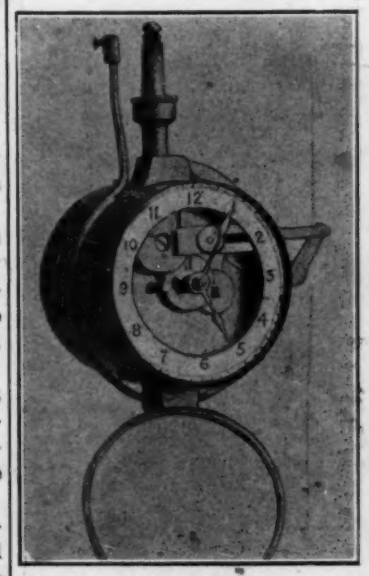


Fig. 9.

In the Shaw (or Automatic) Lighter, Figs. 10, 11 and 12, the clockwork is enclosed in a dust proof case. The valve proper is at the upper end of an inverted "L"-shaped extension on the back of the box. (a) is a leather faced wedge that rocks from side to side, alternately closing the gas passages to the pilot and burner, and is operated through a system of levers moving over a dead spring center (Fig. 12).

The clockwork train drives three operating pin wheels on the same shaft, which rotates once in 24 hours, the pins set to raise the arms of the carriage bearing the weight, at any desired time. Raising

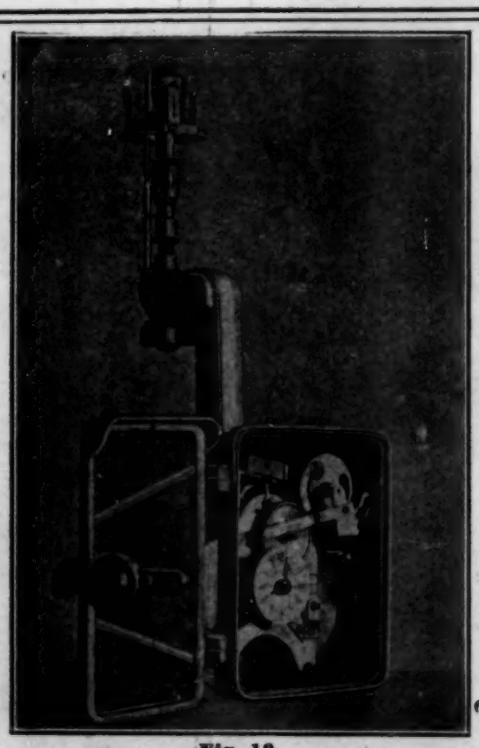


Fig. 10.

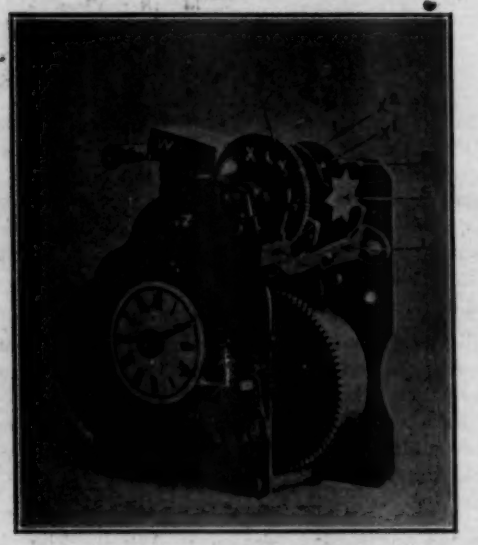


Fig. 11.

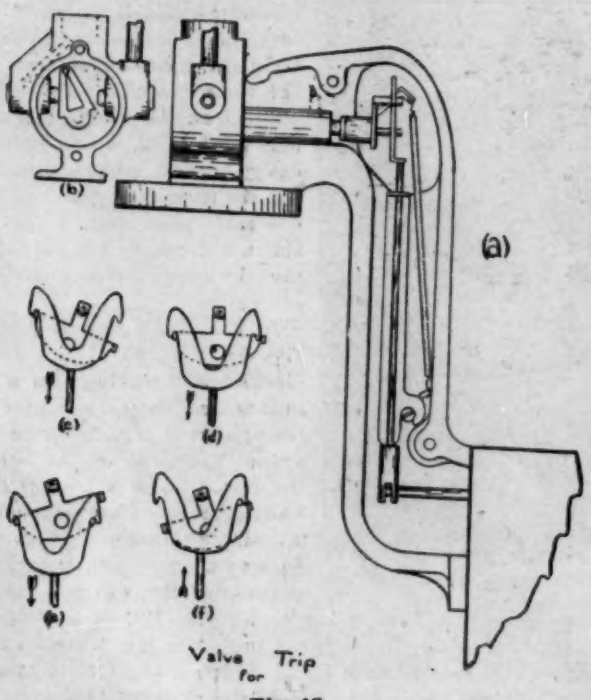


Fig. 12.

the weight lifts a pin which in turn moves the rods to the valve. The front wheel of the rear pair of operating pin wheels is a "lighting wheel" with fixed pin and the rear one is an "extinguishing" wheel similar to it. The relative times of lighting and extinguishing are automatically changed by means of a star wheel in connection with a double worm turning the operating wheels in opposite directions. The star wheel moves one notch backward every 24 hours, according to the location of the operating pin. The separate front wheel can be used for a fixed time of lighting by moving the front arm of the weight carriage to engage the pin. The operating limits are from light at 3:15 P.M. and out at 9:45 A.M., to light at 9:45 P.M and out at 3:15 A.M.

The latest model has only one pin wheel, with two adjustable pins to raise the weight arm that imparts motion to the lever system. The hours are marked on this wheel for convenience in setting. As the weight arm raises, the arm with the double hook at the top is raised to engage the lugs on the valve rocking stem, the valve moving when the pin allows the weight to fall.

The Rapid Clock Lighter is shown in Fig. 13. The time dial carries two projecting pins that alternately move a lever to the right and left. Through a second lever a rocking semi-circular disc is turned to raise a cone valve off its seat in the main gas way. The limits of setting are light 4 to 9 P.M. and out 11 P.M. to 7 A.M. It is inclosed in a box 3½ by 4 by 2 inches, placed directly on the riser in the lantern head.

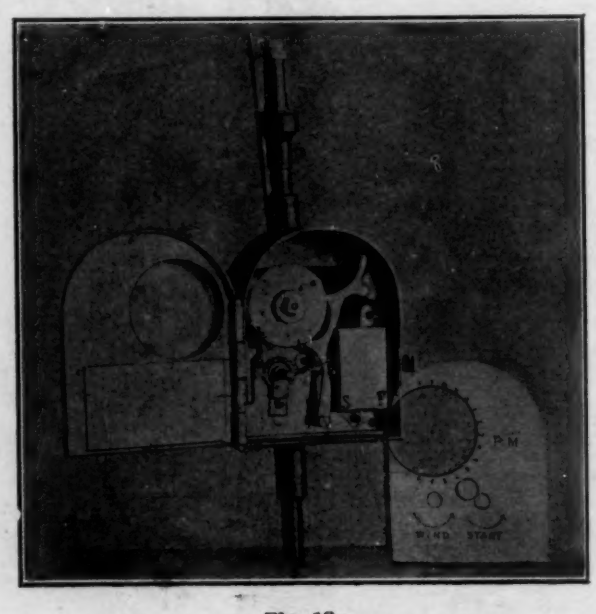


Fig. 13.

Fig. 14 is the Bamag pressure wave lighter. A cast iron case is divided into two chambers by a diaphragm of fine woven material impregnated with varnish. The gas pressure acts on one side of the membrane against a spiral spring on the other side, the tension of which can be altered by setting a pointer on the dial of the outside casing. The horizontal movement of the diaphragm is communicated by a system of levers to a ratchet and cam which raises the cone valve off its seat. The operation of the apparatus takes three cycles, so that by using two styles of cam, half night and all night lamps may be operated on the same line. All the adjustments are from the outside and the apparatus can be operated by hand in case failure.

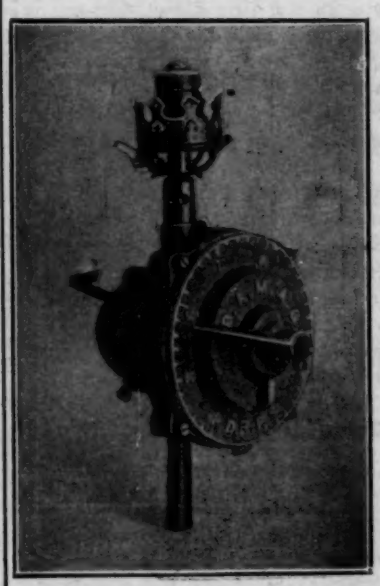


Fig. 14.

The Tourtel-Mealing apparatus consists of a double chamber regulator and a double diaphragm operator. On increase of pressure the seal in the regulator is broken and the gas pressure admitted to the two diaphragm chambers of

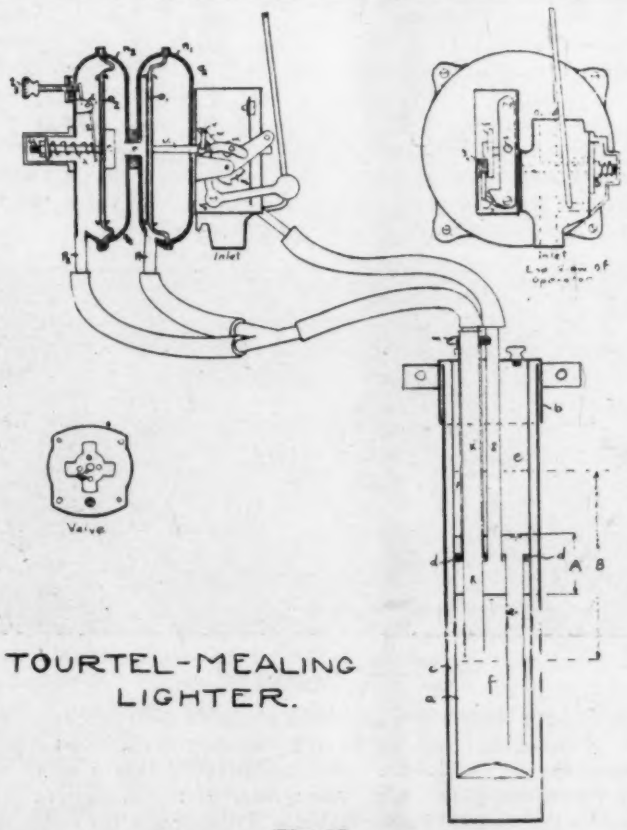


Fig. 15.

the operator. By an arrangement of leak holes and springs the main diaphragm is pushed to the right, operating the ratchet valve. On the beginning of the pressure increase at the operator the secondary diaphragm operating against a spring closes the escape outlet of the main diaphragm. On release of pressure the opposite occurs and the main diaphragm is forced back by a counter balance to prepare for another operation. The valve is a rotating flat disc moving ½ turn at each operation of the diaphragm and having four ports for gas passage.

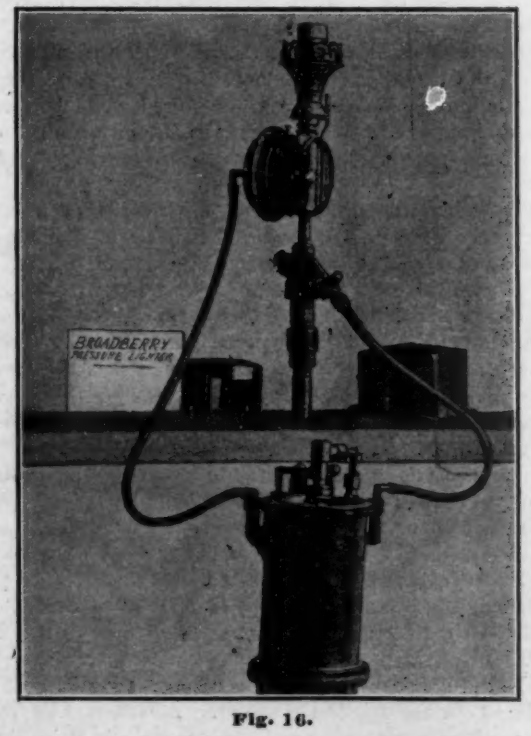


Fig. 16.

The Broadberry is a development of the Tourtel-Mealing type. The controller is divided horizontally into two chambers, the lower open at the top to gas pressure and partially filled with a mixture of water and glycerine. When the pressure is raised some of the liquid is forced from the lower chamber into the upper chamber which contains a float that rises and falls on quick impulses only, a small pinhole in the bottom of the float maintaining the balance on slow increases. On raising this float strikes against a hollow valve stem extending down from a combination cone and clack valve, the flap raising the inlet to the diaphragm from the gas line and the cone regulating the outlet through the hollow stem from the diaphragm to the air, raising it and admitting full gas pressure behind the diaphragm of the operator, which, through a system of levers, moves the cock. When the float falls the valve stem falls and opens the back of the diaphragm to the air, allowing the ratchet wheels to fall back.

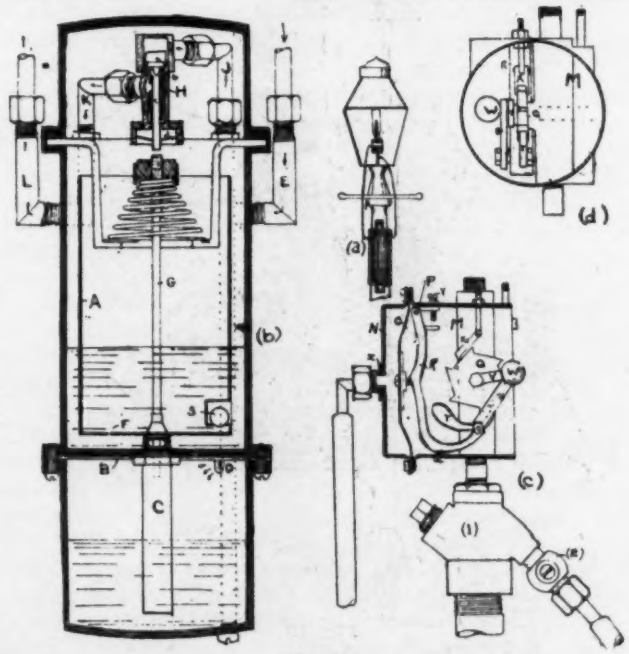


Fig. 17.

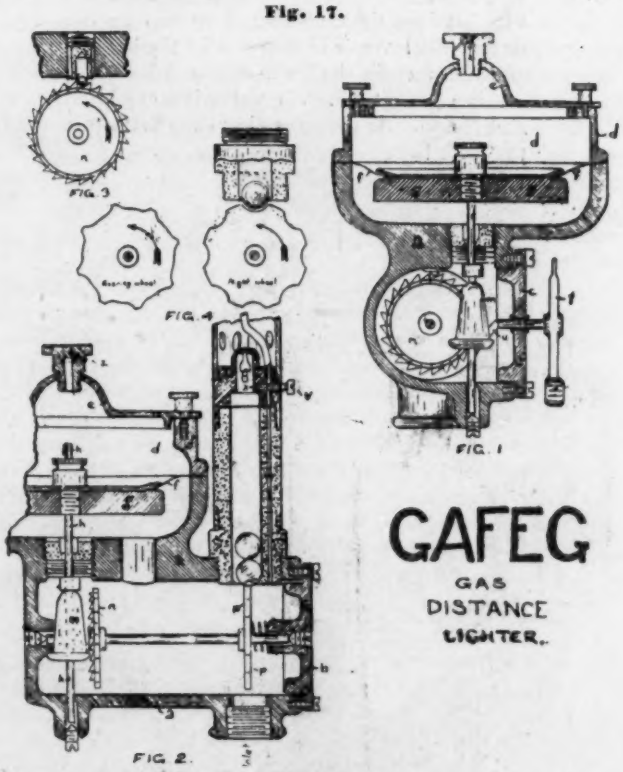


Fig. 18.

In the Gafeg lighter a weighted diaphragm, on increase of pressure, rises, lifting a stem carrying a loose thimble-shaped pawl, that engages the crown teeth of a rachet wheel which turns on the same axis as the lighting cam wheel. The cam wheel raises a ball valve to allow passage of gas. To prevent the rachet-returning a small ball rising and falling in a short tube, drops between the rim teeth of the ratchet and acts as a stop. The complete operation of this device requires 3 pulsations, and by changing the lighting cam all-night and midnight lamps may be operated on the same system.

The Lux Lighter, Fig. 20, operates on the release of a definite increase of pressure for a definite time. The apparatus contains two diaphragms with a helical spring between. On small increase of pressure both diaphragms rise, lifting a series of levers to the "set" position. A small orifice in the center of the upper diaphragm per-

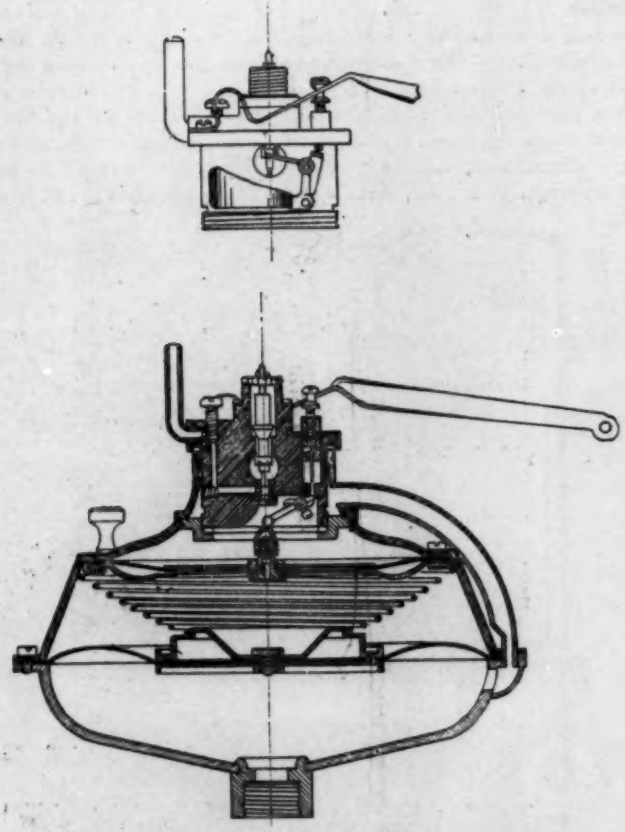


Fig. 19.

mits the pressure between the diaphragms to fall so that the upper diaphragm recedes (the lever is held down by the helical spring.) As the upper diaphragm recedes the lever system falls and the actuating arm turns the valve ¼ of a turn. The valve is a combination vertical spindle cone and piston. As the cone closes the main gas supply, the piston opens the pilot line.

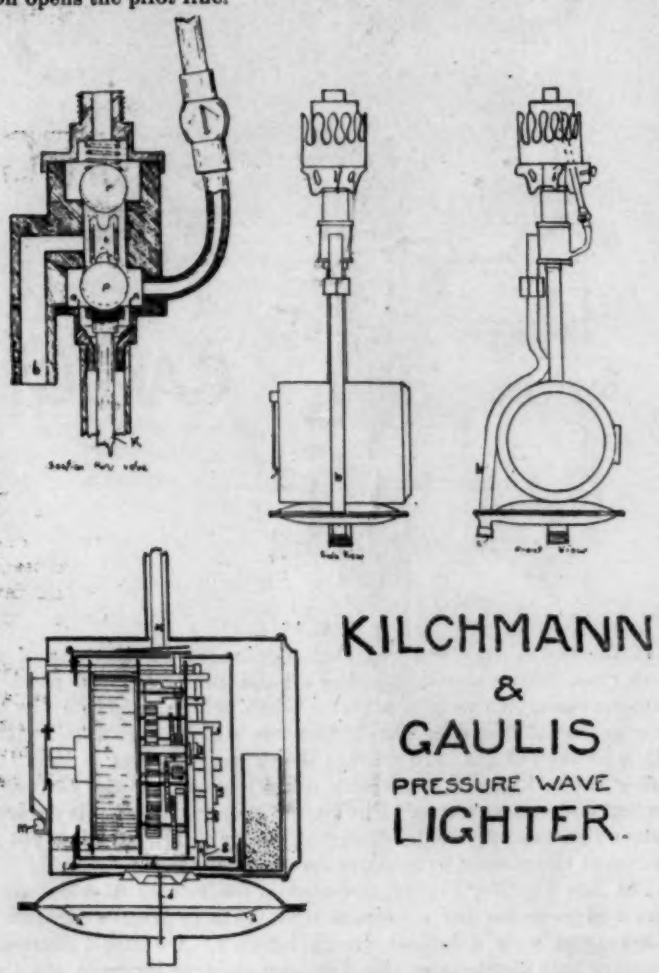


Fig. 20.

The Pressure Wave and Clock, Kilchmann & Gaulis Lighter, is a combination of a pressure lighter and clock. On the increase of pressure beyond a certain maximum the diaphragm rises, raising a trip allowing the clock to move. A cam in the clockwork raises a pin, moving a lever, which pushes up the valve rod. The valve consists of two copper balls with a spacer between, which are alternately seated, closing main or pilot way separately. A spring above the upper ball keeps the main gasway closed until the valve rod raises them. The pilot is an interior blue flame pilot.

Fig. 21.

The Robson Automaton Lighter is a combination apparatus which may, by changing a cam wheel on the driving shaft, be set to operate under different conditions. The clockwork drives a cam, which turns the tapered plug cock. The release of the clockwork is regulated by the motion of a varnished silk diaphragm (*a*) which moves the lower end of the lever (*b*). By weights on levers (*b*) (*b*¹) and the form of cam (*d*), the clockwork will operate on either rise or fall of pressure. The height of the pressure wave may be different for lighting and extinguishing or the apparatus may engage just before the next operation or immediately after the previous operation, whether on rise or fall. The clockwork will run 4 weeks and very little attention is required. By removing two nuts the clockwork may be detached from the riser fo r examination.

Criticisms of Lighters.—All the ills to which apparatus in contact with gas is heir are intensified in the automatic lighter. The points to be considered are the ignition device, the cock or valve, the source of power and the operating mechanism.

In pyrophoric or catalytic lighters the ignition device is the main feature. In th e other types, it is not, as a rule, a prominent feature.

Pyrophoric igniters, when wet or cold, are slow, and in some cases operation is impossible. Heat increases their activity, and their chief disadvantage is that the active material wears out and must be replaced.

Catalytic lighters using platinum, or palladium black, have the same troubles as the pyrophoric, with the additional ones of fusion and evaporation. The active life of the material is not long and from 6 to 15 seconds are required from gas admission to ignition. With the electro-catalytic platinum wire type the deterioration is in the electric battery, which determines the continuous operation of the apparatus. Cells can be obtained that show a life of over a year, and the igniters proper will stand over 60,000 ignitions. Corrosion of contacts is a source of trouble and they should be where they can be easily cleaned.

Pilot troubles cannot be charged directly against a lighter, unless the cock or valve used governs the action of the pilot. Where the pilot is extinguished on ignition of the main burner, the action is sometimes so quick that the first is extinguished before the second is lighted. Pilots inside the mantle are better than outside pilots. If the pilot has a plug cock adjustment instead of a needle, the tendency for drip to collect and, by freezing, stop the gas way is greatly increased.

Cylindrical plug cocks wear and it cannot be taken up. In the tapered plug type the friction gradually increases and the torque necessary to operate is consequently increased. Lubrication of plug cocks outdoors is quite a problem. In cold weather the drip oil will dissolve the lubricant making the cocks dry and tight. Piston valves require packing and develop leaks. Cone, plug and ball valves are liable to corrode and not seat properly. If they seat by their weight, small particles are liable to cause leakage. Flap valves if well made are good, especially if the face is vertical. Rotary disc valves are

probably best, as the wearing surface is self-cleaning and requires little or no lubrication.

In pressure-wave lighters, the life of the diaphragms is important. They tend to harden, and if the material be poor they may almost totally disintegrate before trouble is noted. Small diaphragms seem more subject to difficulties than large ones, especially if in continuous contact with gas.

Clockwork should be simple, and separate for the timing and operating of trains, and have a definite relation between the tripping mechanism and the clock face to facilitate adjustment. Parts liable to screw up and bind should be guarded against. The operating mechanism should contain a minimum number of bearings and be positive in action.

The choice of the type of lighter depends on local conditions. Where the system is greatly spread and the lamps scattered, clock lighters would probably be most satisfactory, while for more congested districts the presssure wave is suitable. The combination pressure wave and clock complicates the adjustment and attention required, though where gas pressure is low it conld be used to advantage.

Clock lighters are more subject to weather conditions than the pressure wave type and more difficult to adjust and repair.

It has been found that a 0.4 inch wave will travel about 400 feet per second to a 30-inch main and 350 feet in a 4-inch main. In this system it is necessary to have pressure control of the entire district from one point. Where the distribution system is fed from scattered holders, it would be necessary to confine the range of each holder to an isolated district.

Pressure wave lighters should be small, self-contained and selective in their action. Cocks are liable to stick and require considerably more force to turn than can be obtained from a small diaphragm, or clockwork.

From a 3-inch diaphragm with 4-inch water pressure the total available force is $9\pi \times .579 = 16.5$ oz., or about 1 pound, acting on a very short leverage. One solution is to use a cock in which friction is negligible; or higher pressures in the distribution mains, when the increase in pressure necessary to start mechanism would be a percentage of the total.

Mercury seals should be avoided because of their corrosive action, and evaporative seals give trouble if not regularly inspected. Operative parts should, as far as possible, be removed from contact with gas. The action of the apparatus should be selective, should respond to only a certain type of wave and not be affected by gradual rise or fall. The ideal lighter would have almost human intelligence and, like the sun valve used in the Lighthouse Service, turn itself on and off at a certain predetermined minimum intensity of illumination.

Report of the Committee on Power Economies In Gas Plants.[1]

[Written for Eighth Annual Meeting, American Gas Institute.]

PART I.—ECONOMICAL STEAM PRODUCTION.

(A) *Fuels.*—Selection of the most economical fuel for a boiler plant is one of the most important questions for the operating engineer, and is often decided for him by location.

Boiler fuels may be divided into three general classes:

Solid: Natural.—Coal, wood and peat.
Prepared.—Charcoal, briquettes and coke.
Liquid.—Oils and tars.
Gaseous.—Natural gas, producer gas, oil gas and commercial gas.

We are most interested in solid fuels, as oils and tars are generally too valuable for use under boilers, and gaseous fuels are little used, as they can be employed with greater efficiency in internal combustion engines.

Coal is the fuel most used for steam production, and exists in various forms from a comparatively recent cellulose growth, such as lignite, to that of anthracite coal, which is nearly pure carbon. They are usually classified according to the proportion of volatile matter as follows:

Anthracite	Vol. Matter	3 to 7 per cent.
Semi-anthracits	"	7 to 13 "
Semi-bituminous	"	13 to 25 "
Bituminous	"	25 to 50 "
Lignite	"	50 per cent. and over.

Anthracite is almost entirely carbon, is slow burning, gives practically no smoke and contains very little ash or inorganic matter. Semi-anthracite burns more freely than anthracite, does not cake or clinker to any extent, but requires considerable draught to properly burn it, and is expensive and difficult to obtain.

Semi-bituminous is probably the best steam coal. It is fairly free burning, requires only a moderate draught, is generally low in ash and, although a coking coal, does not clinker badly, but gives some trouble from smoke unless burned in properly designed furnaces.

Bituminous coals are also used to a great extent. They vary greatly in composition and to be satisfactory must be burned in correctly designed furnaces.

Lignite is seldom used as a boiler fuel, as it is too high in volatile matter and moisture, except where the price of other coals is prohibitive.

Coke, except in the form of dust or breeze, is too valuable for use under boilers, as are also manufactured fuel briquettes.

Choice of Fuels.—Generally the fuel that will give the greatest value in B.T.U.'s per dollar will prove to be the most economical. Where several fuels have a nearly equal B.T.U. value per dollar, it may be well to consider other things. Some plants have a choice of small sizes of anthracite, semi-bituminous and bituminous coal, and of many grades of each. First settle the kind of coal, and then the particular grade which will give the greatest efficiency.

In considering the first question, the equipment of the boiler plant must first be considered. Furnaces designed for anthracite coal are seldom efficient for semi-bituminous or high volatile coal. Grates designed for one kind of coal are seldom satisfactory for another, and the available draught must be considered as affecting economy and capacity. The relative cost of handling to the boiler room, fire room, labor, and ash handling must be considered, as a cheaper fuel high in ash may require as much as 50 per cent. more labor in handling.

The question of smoke nuisance is important in many cases, and becoming more so each year. Bituminous coals cannot be burned without smoke except in specially designed furnaces or by good mechanical stokers.

The most satisfactory method of determining the relative efficiency of coals that appear to be equal in B.T.U. per dollar, is by carefully conducted comparative tests on individual boilers, or preferably on the entire plant, using each grade of fuel for several weeks.

After the kind of coal has been selected there usually is a choice between different mining regions or different mines. The usual practice is to buy on a B.T.U. basis, determined by calorimeter test on average samples. This method is not entirely satisfactory, as samples are usually better than the general run. In addition to their B.T.U. values, the proximate analyses of samples should be considered, especially moisture, volatile combustible and ash content, and fusing point of the ash.

(B) *Feed Water.*—The function of a steam boiler being the evaporation of water into steam by transfer to the water of the heat units in the coal burned, it is desirable to understand the peculiar properties of waters and the effect of the contained foreign matters upon the boiler itself, and on its efficiency as a steam generator; and also the methods used to rid boiler feed waters of such objectionable matter.

All natural waters contain some foreign matter in suspension or in solution, but there is great difference in quantity and in their chemical action at high temperatures.

Impurities in boiler feed water cause three kinds of trouble:

1. Incrustation, or the formation of scale on the water side of the heating surfaces. This is caused by;
   (a) Mud or other suspended matter.
   (b) Soluble salts.
   (c) Bicarbonate of lime or magnesia.
   (d) Sulphate of lime.
2. Corrosion of the metal in the boilers can be caused by;
   (a) Acids.
   (b) Chloride or sulphate or magnesium.
   (c) Grease or oil.
   (d) Organic matter.
   (e) Dissolved carbonic acid and free oxygen.
   (f) Electrolytic action.
3. Priming or foaming in the boiler may be due to;
   (a) Oil.
   (b) Scum on the surface of the water formed by sewage or other light suspended matter.
   (c) A large excess of carbonate of soda or other alkali.

(*Continued on page* 122.)

1. Slightly abridged.—EDS.

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THOMAS J. CUNNINGHAM, SANFORD K. CAMPBELL, } Editors.

NEW YORK, MONDAY, FEBRUARY 23, 1914.

[Special Editorial Correspondence.]

FORTY-FOURTH MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

YOUNG'S HOTEL, BOSTON, MASS., February 18th, 1914.

Last evening offered weak hope for a large early attendance at the New England Association's 44th session, a bleak east wind with low temperature and clouded skies betokening an old-fashioned New England winter storm; but this morning it was different. Bright sunlight and a rapidly upgoing move of the mercury in the tube brought about happier conditions. I wrote "happier," but "bearable" would be nearer the mark, for wherever the delegates and visitors assembled, be the knots many or few, gloom was in the air and monosyllables were from the mouths of those who conversed. And all this quiet and gloom came from the subject for thought and sympathy—the death of Charles F. Prichard. Manfully and well had he labored for the Association, in acknowledgment of which his fellows had honored him to the limit of their powers.

The opening session of the meeting was marked by an attendance that completely filled the sessions' room, and even overflowed through the exits to the halls. Mr. T. H. Hintze, wheel-horse that he is, smiled broadly as he called the splendid assemblage to order, and truth-to-tell, even placid Secretary Gifford's glance over the clans was punctuated by a lean-to-remark made to the imperturable reporter Lovell just as the gavel fell. The first real business was the annual report of the Directors, the main item therein being that Messrs. C. D. Lamson, W. R. Addicks and C. H. Nettleton be elected to Honorary Membership. It is needless to say that this thoughtful recognition was most heartily indorsed. Then followed the election of several new members, the number signing the rolls being sufficient to bring the total quite over 250. Following one or two other routine matters President Hintze read the annual message. Its well arranged sentences had much to do with the history and work of this non-hysteric body, and in sequence he passed into the predicting mood by means of horoscopy (save-the-word) as to its future. But in the horoscoping was very much of the practical. For instance, he declared that a serious handicap to its growth and extending influence was the limited capacity of its permanent home quarters, emphasizing this by remarking that the Association, instead of being bound by decidedly conservative ways-and-means, must now be recognized along the lines of pioneering, even unto the point of experimentating. Again, he asked that precedent be violated through not re-electing him to the Presidency. Of course, his referrings to the great loss sustained by them in the death of ex-President Prichard were such as one would expect from a big-hearted, resourceful man and friend. Certain special committee appointments having been announced, the paper list was taken up. The first one considered was that by Mr. C. A. Learned, whose "Notes on Vertical Settings in English Works," constituted a splendid recounting of his inspectings of many important vertical plants in Great Britain during his sojourn abroad last year. His really illuminating comments provoked a discussion that was superlatively interesting and positively instructive. That it must have been both is surely proved by the discussion when it is said that amongst those who participated in it were Messrs. De Hart, Nettleton, Stiles, Taussig, Miller, Ramsburg, D. R. Russell, Africa (quite recovered from his recent illness), Ellis and Dr. Burgi.

The next paper was on "Intensifying Output," by Mr. H. C. Crafts. The author's intelligent handling of the subject was particularly along the lines of rigorously promoting "Rental-Purchase Campaigns," for water heaters. It is to be regretted that the discussion was not carried to greater lengths, for there was much in the paper to stimulative the narrative of the practices of others in these regards. Possibly the approaching time to luncheon may have been a potent factor in the curtailing. Then comes a pleasing interlude, brought about by Mr. W. H. Gartley, President American Gas Institute, who, speaking as Chairman of the Committee on the proposed International Gas Congress, gave a pithy resume of the work so far done in this connection, and also mentioned some tentative plans now being prepared therefor. This brought us to the Report of the Nominating Committee, who submitted a list of office-bearers for the year—it is needless to say they were ratified unanimously in the subsequent balloting:

President.—Mr. C. A. Learned, Meriden, Conn.
First Vice-President.—Mr. H. K. Morrison, Brockton, Mass.
Second Vice-President.—Mr. H. C. Crafts, Pittsfield, Mass.
Secretary and Treasurer.—Mr. N. W. Gifford, East Boston, Mass.
Directors.—Messrs. J. F. Wing, A. M. Barnes, A. B. Tenney, J. A. Norcross and Carroll Miller.

This ended the first session of the first day.—CAMP.

The afternoon session was convened at 2:40 o'clock, and without any waste of time Prof. S. H. Woodbridge, of the Massachusetts Institute of Technology, commenced to deliver his really fine lecture on "Ventilation," which was illustrated by slides, well-thrown on the screen. In its recital he aptly contrasted the attitudes of two types of engineers—the engine engineer and the energy engineer—cleverly showing the crude thought and methods of the former as applied to matter and force as illustrated in the candle flame processes. He submitted some new tables for calculations in respect of moving volumes of heated air in ventilation problems. He next described two experimental gas heating stoves and the results obtained with them. He also spoke of the house heating problems that are at the very moment ready for the practical consideration of gas engineers. The Professor was justly awarded a rising vote of thanks, after which Mr. Barnes (for the Committee on Memorial to the late Charles F. Prichard) presented a beautifully expressive series of minutes to deceased. Dr. J. F. Wing followed with his paper on "Chemical and Physical Properties of Lubricating Oils," which will stand as a reference work for many a day. Mr. E. R. Hamilton's scholarly paper giving "Data on the Influence of Copper on the Corrosion of Iron and Steel," was mainly a compilation of his experiments with samples of various wrought pipe material. He also submitted interesting analyses of some service pipes that had been buried 50 years or more. The discussion on this topic was brilliantly led by Mr. H. A. Carpenter (of the Riter-Conley Company), whose recital was that of a man thoroughly versed in the many and odd phases of the subject. He was followed by another master along these lines, Mr. Carroll Miller. At this juncture the hour for adjournment had arrived, so it was wisely decided to carry over the discussion until the paper by Mr. Speller, on "Ore to Finished Pipe," shall have been read, a conjoint discussion to follow. Now for the banquet.—CAMP.

BOSTON, MASS., Feb. 19, 1914.

The banquet last night was of the usual New England type, but the memory of Prichard overshadowed it all. In fact, at one time it was seriously thought to omit it, substituting therefor a memorial service, but this thought was put aside in the remembering that such action would not be the way that Mr. Prichard would sanction. Those participating numbered well over 100. The proceedings were directed by President Hintze from the toastmaster's chair, and the speakers included Messrs. C. A. Learned, C. H. Nettleton W. G. Africa, W. H. Gartley and J. M. Brock, the latter contributing whatever expression of hilarity was made.

This morning's session was declared at 10 o'clock, with a dip into the Question Box. Then came Mr. Seller's excellent narrative-description of the manufacture of wrought iron pipe, well illustrated by motion pictures of the process. The films showed steam shovels digging the ore, its loading on and removal from barges, and its detailed treatment until finished and tested as pipe. Many questions were put to Mr. Speller, and the matter of copper content was again

touched upon. The paper by Mr. G. H. Priest, on "Valuation of Street Mains and Services," was a well told outline of the things to be considered by an outside engineer when valuing a distribution system. The final number was that prepared by Mr. G. A. Smith, Jr., whose subject was entitled "Some Experience in Automobile Operation," and it contained many tables showing results obtained by his Company in the operation of motor vehicles. The discussion brought out some valuable comparisons between the respective merits of gasoline and electric trucks; also, the advantages of rough tread tires. At 1:10 P.M. President Hintze thanked the members for the manner in which they had assisted to make his administration a success, and to cause the records of the meeting to be well worth while for future study.—CAMP.

ACTION TAKEN BY THE GUILD OF GAS MANAGERS, RESPECTING THE LATE MR. CHARLES FLORENCE PRICHARD.

We are indebted to the attention of Mr. H. K. Morrison, Secretary, the Guild of Gas Managers, for the following mention of action taken at a special meeting of the Guild held to pay tribute to the memory of Mr. Charles Florence Prichard:

Mr. Prichard was born in Marblehead, Mass., on June 10, 1856. His early education was obtained in the Marblehead public schools, from which he entered the Massachusetts Institute of Technology, and was graduated in 1876.

Soon after graduating he began his career in the gas industry with the Worcester (Mass.) Gas Light Company, going from there to Pontiac, Mich., thence to Dedham, Mass., where he served, until 1883, when he was appointed Superintendent of the Lynn (Mass.) Company.

At that time the Lynn Company was a very small concern, the earliest statistics published by the Board of Gas and Electric Light Commissioners, covering the year ended June 30th, 1886, showing a total sales by the Lynn Company of 38,398,700 cubic feet, at an average price of $2 per 1,000 cubic feet. To-day, owing to Mr. Prichard's able management, the Company stands the third largest lighting corporation in Massachusetts, the other two being the Boston Consolidated Gas Company, and the Edison Electric Illuminating Company, of Boston. The entire present outfit in Lynn is a strong testimonial to his ability and skill as an engineer, being a model of efficiency in operation, and a worthy example of satisfactory public service.

His wide and varied experience, combined with his natural ability and sound judgment, soon caused him to become a recognized authority in his profession, and his services as an expert were in request far-and-near, even to the Pacific Coast. His opinions, stated clearly and concisely, were supported by sound arguments; and, while firm in his convictions, he was always tolerant of the views of those who might differ with him. He never rode a hobby nor played to the galleries.

Mr. Prichard was married, September 11, 1882, to Miss Florence Greer, of Dover, Mass., who survives him, with a son and daughter, both married. Mr. Prichard's home and family were sources of great happiness to him, as all know who were privileged to see this side of his life. He was a devoted husband, a loving father, and, in his later years, a proud and admiring grandfather.

He was a regular attendant at the meetings of this organization; in past years had served as its President; and he was alike a valued counsellor in its discussions, in matters brought before the Guild for the good of the order, and a frequent and entertaing contributor to the enjoyment of the after-dinner hour.

To those of us whose good fortune it was to know him intimately, his leading characteristics were his cordial greeting; his cheery smile; his modest and unassuming bearing; his sincere and unruffled disposition, even in very trying situations; his sincerity; his generous hospitality; his readiness to co-operate and assist in all things pertaining to the welfare of the lighting industry; his kindly interest in the problems or difficulties confronting others and his willingness to keep in solving or overcoming them.

To have been associated with him is a delightful memory; to have had him for a friend, a distinct blessing.

"None knew him but to love him.
None named him but to praise."

ALBERT M. BARNES,
WM. A. WOOD,
S. J. FOWLER,
Committee of the Guild of Gas Managers.

BRIEFLY TOLD.

IN MEMORIAM.—CHARLES F. PRICHARD: SOCIETY OF GAS LIGHTING.—We are indebted to the attention of Mr. George G. Ramsdell, Secretary, the Society of Gas Lighting, for this report of the action of the Society of Gas Lighting, regarding the memory of the late Charles Florence Prichard: The members of the Society of Gas Lighting have learned with great sorrow of the death (January 21st, 1914), of their friend and aud fellow member,

CHARLES F. PRICHARD,

and, to place on record some statement of their appreciation of him as a man and as an engineer, this minute has been prepared.

Mr. Prichard was graduated from the Institute of Technology (1876) when 20 years of age, and immediately started in the gas business: First at Worcester, Mass.; next, at Pontiac, Mich.; then at Dedham, Mass. In 1883 he went with the Lynn (Mass.) Company as its Superintendent, becoming its General Manager in 1901. In 1908 he was elected Vice-President, in addition to the position last named.

Outside of his own Company, he was a Director in a number of other gas companies, and in his own city he was very active; one of the notices published at the time of his death stating that "He was one of the best and most favorably known men in Lynn."

In gas association work he for years has been very prominent. He had been President of the New England Association of Gas Engineers; the Guild of Gas Managers; the American Gas Light Association, and the American Gas Institute. At the close of the last meeeting of the Institute he remarked that he "Had attended the meetings of that Association, and its national predecessors, for 32 years without a break."

As a gas engineer and manager he was very successful, as proven by his management of the Lynn Gas and Electric Company for the past 31 years. He acquired a national reputation in gas company matters, and his advice and judgment were frequently sought, both by his friends and those who knew him only by reputation. He attained this prominence by his ability, his good judgment, and his sterling character, unaided by friends or outside influence.

At the funeral the following quotation, from Ecclesiasticus, was read, and it so aptly describes the work, the attainments, and the character of our friend, that it is repeated here:

"All these put their trust in their hands,
And each becometh wise in his own work.
Yea, though they be not sought for in the council of the people,
Nor be exalted in the assembly.
Though they sit not on the seat of the judge,
Nor understand the covenant of judgment;
Yet without these shall not a city be inhabited,
Nor shall men sojourn or walk up and down therein.
For these maintain the fabric of the world,
And in the handiwork of their craft is their prayer."

But however great his business and professional success may have been, the members of this Society, particularly those who have been associated with him for many years, love to think of him as a man and a friend. Genial, kindly, modest almost to a fault, he made an impression on others that was very unusual, and his companionship was eagerly sought. His large circle of friends sincerely mourn his loss; and for some of us a vacancy has been created that will be difficult, if not impossible, to fill. To his family we tender our warmest sympathy in their great loss.

On behalf of the Society,
CHARLES H. NETTLETON,
SAMUEL J. FOWLER,
WILLIAM E. MCKAY,
} Committee.

JOINT MEETING, ILLUMINATING ENGINEERING SOCIETY AND MUNICIPAL ART SOCIETY OF NEW YORK.—The Illuminating Engineering Society, New York Section, held a joint meeting with the Municipal Art Society of New York, at the Engineering Societies Building, 29 West 39th street, on February 11th, 1914. In the absence of the presiding officers of both organizations, Mr. S. H. Stickney presided. Mr. Arthur Williams, representing the Municipal Art Society, was introduced as the first speaker of the evening, and gave a brief address on Street Lighting, referring particularly to New York City. He gave an outline of the relation of the lighting companies and the municipality with reference to service, the rental or taxes paid to the municipality, the revenue received by the Lighting Companies, and the salaries paid to the employees of the Companies.

He said that New York City's lighting bill for 1912 was as follows:

Electricity	$2,201,628.25
Gas	1,037,431.13
Naphtha	51,133.10
Total	$3,290,192.48

The Chairman then introduced Mr. C. F. Lacombe, Illuminating Engineering Society, who spoke of his recent trip abroad investigating lighting conditions in European cities, illustrated by photographs of the varied conditions that he found. He showed slides of street lighting conditions in England, Germany, France, Scotland, Spain, Italy and some other countries. He found lighting systems that were good, bad, and indifferent; and while some of the larger cities provide higher intensity of illumination in some of the busy thoroughfares and congested centres, the general average of illumination does not compare with that of New York city. Mr. Lacombe said that the residence and commercial lighting in European cities in no way compared with the progress made here along these lines. The lecture contained a great deal of valuable information, and while time permitted Mr. Lacombe to say but about one-half of what he could tell, showed that a great deal of time and effort had been put into the investigation. A round number of the members of both organizations met at Murray's Roman Garden, at 6 P.M., and partook of a good informal dinner, before the meeting.

(*Continued from page* 119.)

Scale forming is a source of danger if allowed to continue until it interferes with transmission of heat to the water. Scale may cause bagging of the shell plates, above the furnace, and serious accidents. In water tube boilers it may cause blistered tubes, involving replacements and serious accidents. It is unusual to find boilers in operation having dangerously heavy scale, but even thin scale may prove a source of loss and danger, especially in water tube boilers, operating at high ratings, as loose pieces of scale may pile up, preventing water from coming in contact with the tube. This is a common cause of blistered tubes, and they usually show a pile of loose scale at the point where the blister formed.

Scale also causes loss of economy but it is difficult to obtain reliable data on the effect of different densities and thicknesses. Manufacturers of boiler compounds and feed water purifiers would have us believe that even a very thin scale causes considerable loss, and while this may be true, the loss is not as great as often stated, for most forms of boiler scale are fairly good conductors of heat, and it is doubtful if scale under $\frac{1}{16}$ inch in thickness will cause much loss in efficiency. As a rule a soft, porous scale causes greater loss than one hard and dense.

The following from tests made at the University of Illinois, give an idea of the effect of scale on economy, but there is so much difference of opinion on this subject that the figures should be used with caution:

Thickness of Scale in Inches.	Character of Scale.	Per Cent Decrease in Conductivity Due to Scale.
0.033	Soft.	4.3
0.033	Very hard.	3.5
0.04	Soft, porous.	6.82
0.04	Hard, dense.	3.07
0.07	Soft.	2.38
0.07	Hard.	4.43
0.085	Soft, porous.	19.0
0.089	Very soft.	4.95
0.11	Hard, porous.	16.73
0.13	Hard, dense.	6.75

The important facts to be remembered are that the scale in boilers is uot only expensive in repairs and dangerous, but does cause loss of efficiency which may amount to 20 per cent.

Corrosion in steam boilers is a source of danger and loss.

Priming is more dangerous to the machinery using the steam, than to the boilers themselves, but it may also cause loss of economy. If engines have efficient steam separators and the steam lines are well drained, the boilers may prime badly without danger to the plant, but the heat loss from water which has been raised to the temperature of steam and is removed from separators and pipe lines, may be considerable. The cause of priming can usually be detected and removed, and a good boiler, even when operating at high overload, should deliver steam with not more than 1½ per cent. of moisture.

Blowing Down.—In the generation of steam, pure water only is removed from the boiler as steam, and most of the impurities remain. As the process advances, new water containing impurities continually enters the boiler, and they remain when the water is evaporated into steam. Some of the concentrated impurities are deposited as scale and some remain in solution or as suspended matter. Blowing down a boiler will reduce the concentration, by removing water containing an excessive amount of impurities and allowing fresh water to take its place, but the quantity blown out at any one time is only a small percentage of the total water in the boiler. Some soft sludge and scale also are removed by blowing down, but not enough to prevent scale formation. Considerable heat is lost when water at the temperature of steam is blown out, and if a boiler were blown frequently enough to lessen concentration, the loss would be great. It is advisable to blow down at regular intervals to remove sludge from around the blow off, but it has little effect on scale formation, corrosion or priming.

Mechanical Cleaning.—Scale can be removed from boilers by mechanical cleaners or scrapers, and this is the most economical method, where good water is used and only light scale formed. In plants using bad feed water this method is expensive and unsatisfactory, as these cleaners are expensive to keep in condition, dangerous to the tubes if not properly handled, and usually leave a light coating on the iron. Scale removal mechanically means idle boilers during cleaning, extra labor dismantling boilers and cleaning, injury to fire brick arches, and power to operate cleaners.

Heating Feed Water.—There is unquestioned economy in heating feed water with exhaust steam, but without chemical treatment it has little effect on scale formation. Some of the carbonates are precipitated in water heaters, if heated above 200° F., but it is likely to be gradual and take place not only in the heater but in the feed lines. If the water is treated with the proper chemicals and a settling tank used to allow time for the chemical reactions, and an efficient filter to remove the suspended matter, the system will be fairly reliable purifier for some waters.

Boiler compounds are usually composed of lime and soda ash, with other substances which may or may not add to their value. Compounds may be either introduced into the heater, in which case they are likely to be inefficient unless a proper settling chamber gives them time for reaction, or direct into the boiler, where they cause increased precipitation and formation of soft sludge which may be more injurious than hard scale, though easier to remove. They are often a help in maintaining plant capacity and in reducing cost of boiler cleaning as they help prevent hard scale, but it is doubtful if they increase operating efficiency.

The proper method of purification of feed water is by the chemical treatment before it enters the boiler.

There are several purification systems on the market that are efficient, if properly operated. The question for each case, is, can a great enough increase in economy be obtained to cover interest, depreciation and maintenance charges on a purification system.

A purification plant can be installed for from $1.50 to $3.50 per horse power and the cost of chemicals for purification ranges from 1 cent to 4 cents per 1,000 gallons. Most systems require little attention and no additional operating labor charges, and their depreciation and maintenance charges should not exceed 8 per cent.

The saving by the use of purified water depends largely on local conditions, but in most cases the following can be effected:

(a) Increased life of boilers. Corrosion is reduced and wear on tubes and shells, due to frequent cleanings.

(b) Increase in time of operation of boilers in a given period. Less time out of service for cleaning and repairs, and fewer reserve boilers required.

(c) Saving in maintenance of settings and other brickwork, injured during cleaning, and by frequent cooling and reheating.

(d) Saving in pipe and fitting replacements, necessary when scale forms in them.

(e) Saving in valves and fittings throughout the plant. Steam always carries some entrained moisture, and this contains concentrated impurities.

(f) Saving cost of compounds, if previously used.

(g) Saving in labor for opening up and closing boilers, and for cleaning.

(h) Saving of repairs to mechanical cleaners.

(i) Saving power used for operation of cleaners.

(j) Saving in fuel due to clean heating surfaces.

Heating Feed Water.—At usual steam pressures and heater inlet temperatures there is an increase in economy of 1 per cent. for every 12° rise in temperature of the water in the heater.

Closed heaters are usually located on the discharge side of the feed pump. Open heaters are placed on the suction side of the pump, and high enough to give sufficient suction head to prevent vapor forming in the suction pipe or water end of the pump.

Open heaters have back pressure valves, and may be injured if these valves fail to open. Closed heaters are designed for pressures far in excess of the working pressure, and do not rely on valves to protect them.

In open heaters water can be heated to the temperature of the exhaust steam. In closed heaters the temperature of the water never quite equals that of the steam. Oil and scale soon coat its tubes and reduce the efficiency of the heater.

Open heaters are easy to clean and most types of closed heaters difficult.

Oil in the steam mixes with the water in open heaters and cannot be entirely removed, while in closed heaters no oil enters the feed water.

(f) With open heaters the water must be pumped into the heater, and then from the heater to the boilers, which is uneconomical, especially as hot water has to be pumped.

In spite of the disadvantages of the open heater given, it is usually preferred on account of its greater maintained efficiency.

(C) *Boilers.*—Boilers are divided into two general classes—fire tube, in which the gases of combustion pass through the tubes, and

water tube, in which the water circulates through the tubes and the gases pass around the outside of the tubes.

In considering power economies it will be assumed that boilers are properly designed for efficient steam generation, and only these features liable to changes during operation, and which prevent the boiler from absorbing a maximum quantity of heat from the fuel burned, will be considered.

Causes of Inefficiency of Boilers.—(a) Scale or sludge deposit on the water side of the heating surfaces, which decreases the heat absorptive efficiency.

(b) Deposit of soot, dust or carbon cake on fire side of heating surfaces which decreases the rate of heat absorption.

(c) Inefficient baffling, which allows the furnace gases to pass out at high temperatures.

Losses Due to Foul Heating Surfaces.—It has been shown that scale formation will adversely affect boiler economy. But though some forms of boiler scale are poor conductors of heat, carbon in the form of cake or loose dust is a worse conductor. It is generally understood that scale is dangerous, and care is usually taken to prevent its becoming so heavy that the boilers might be injured. But soot and carbon deposit can be allowed to accumulate until the gas passages or tubes are so choked that the draught is almost shut off, and heating surfaces so foul that the preventable loss of sensible heat in the escaping stack gases is greatly increased.

It has been found that the loss due to a carbon deposit, $\frac{1}{16}$ inch thick, may amount to as much as 20 per cent. Steam jets will remove loose dust and soot from a boiler and will reduce the rapidity of carbon cake formation, but they will not altogether prevent it.

Mechanical Cleaning of Heating Surfaces.—If boilers are to be kept in the best condition this carbon deposit must be removed at regular intervals, and should have the dust and loose soot removed by frequent blowing with steam jets while in operation. Mechanical cleaning may be accomplished by the following methods:

(a) By brushing off surfaces with wire broom.
(b) By specially designed scrapers.
(c) By knocking or hammering with a rod or pipe.
(d) By filling the boiler with cold water and passing steam over the fire side of the surfaces, causing the carbon deposit to crack and drop off.
(e) By the use of a mechanical cleaner, which causes enough vibration in the tube to knock off the deposit.

None of these methods is entirely satisfactory, and the operating engineer must choose the one best suited to his case. Experiments have been made with a compound of saltpeter, which, it is claimed, will momentarily increase the temperature of the gases enough to burn the carbon deposit to ash, which can be blown out of the stack.

With hand operated jets, it is the usual practice to blow out the dust once in 24 hours, although with most fuels it is found that dust begins to collect on the tubes immediately after it is blown out, and that, at the end of 6 or 8 hours, the heating surfaces are again coated. This would indicate that you should blow out boilers at least every eight hours, but with hand blowers this would involve increased labor cost. For this reason the mechanical soot blower is a desirable equipment. It has the advantage that with it a large part of the boiler is blown out at once, so dust is not blown from one part to settle on another. On a test made on a 360 horse power B. & W. boiler in a large gas works, it was found that, by using the blower every six hours instead of once in 24, the average stack temperatures were reduced 110°, and the boiler efficiency increased about 4 per cent., with a saving of 6 hours labor of one man.

Mechanical blowers are expensive to install but are worth considering where fine bituminous fuel is used, or where extra labor is required for hand blowing.

In using any blower, it must be supplied with absolutely dry or slightly superheated steam, at the highest obtainable pressure. Long runs of small pipe must be avoided, and the lines to them should be well drained. If wet steam is blown against the tubes it will make a pasty carbon formation that will bake on the tubes.

Baffling.—Boiler baffles are designed to so deflect the gases as to bring them into contact with all the heating surface, without too greatly obstructing the gas passages. Standard baffles are generally efficient for the type of boilers for which they are designed, and it is not often advisable to change the baffling without consulting the manufacturer. All brick baffles, but especially the vertical type, are likely to prove inefficient if they are not perfectly tight. It is considered good practice to cover vertical baffling with plastic fireclay cement, which fills the openings around the tubes and between the tile. This is sometimes done with horizontal baffles to insure their being tight, but it is not so important. For horizontal baffling there is usually a choice for the lower baffle between C tiles which enclose the tubes or T tiles which rest on top, leaving the lower half of the tube exposed. C tile is recommended where bituminous and semi-bituminous coals are burned in furnaces having insufficient combustion space. They are higher in cost and more expensive to maintain than T tile, as they burn off and drop out of place. With a furnace properly designed for bituminous fuels, and with anthracite coal, slightly better efficiency has been obtained in comparative tests, when using T tile.

Types of Grates.—Grates are divided into three classes—stationary, shaking and mechanical stokers. Stationary grates are the oldest form and in most general use. They are of cast iron, with air spaces of usually slot or cone shaped holes. The percentage of air space in any grate varies with the fuel and nature of the draught, but they should be designed to give greatest possible percentage of air space without the openings being wide enough to weaken the casting or allow good fuel to drop through. A grate is an additional resistance to the passage of air through the fuel bed, and this resistance should be reduced as much as possible.

Stationary grates are low in cost, and can be easily replaced when burned out, and have comparatively long life.

Shaking grates are higher in first cost and likely to burn out more rapidly, as the bars are in contact with hot fuel when fires are shaken down. They are a decided advantage with bituminous coals which clinker badly, as the clinker can be broken up and shaken into the ash pit without the frequent use of a slice bar. This usually means a saving in labor, less frequent opening of the fire door, with consequently less cold air taken into the furnace, and a better distribution of air to the fire. With small size anthracite and other high ash coals the dumping grate may be used to advantage, as time will be saved in cleaning fires. If the ash pits are so arranged that they can be dumped into conveyor or cars, there is little doubt as to the desirability of shaking and dumping grates, but if the ash pits must be drawn through the doors, dumping grates are of doubtful value, though shaking grates may be used with advantage.

Stokers.—Mechanical stokers can often be installed to advantage, if plant conditions are right.

It is claimed that stoker fired furnaces give the following advantages over hand fired:

(a) Better maintained economy of operation.
(b) Less labor required.
(c) Smokeless operation with high volatile coals.
(d) Better control of steam pressure under variable loads.
(e) Better economy at high overload capacities.

As high efficiency has been obtained with good hand firing as with any stoker, and it is the general opinion of boiler engineers that, except with high volatile bituminous coals, a first-class fireman can obtain slightly better results, with a properly designed furnace, than can be obtained with a stoker. The reason for this is obvious, when we consider that a first-class fireman does all that a stoker does, and in addition gives what no machine can give, the benefit of his expert knowledge. Stokers claim to give uniformity of feed of coal, proper air supply to the fuel bed, and admit no air over the fire and automatically clean the fire. Various types of stokers do these to a greater or less extent, but a first-class fireman can improve on a stoker in fuel distribution and air supply, which are the most important items for efficiency, and he can keep cold air losses and cleaning losses to a minimum. Please note that we say "first-class fireman;" for it is on this term that most of the following depends. A really first-class fireman, a man who understands combustion and has the will and ability to use his knowledge, is about as rare as the Dodo. Fairly good firemen, who can be depended on to do as they are told, are seldom found in the ordinary fireroom, because they are in demand for special testing work at higher wages, and because men of that caliber soon graduate from the fireroom into the engine room. Fire room labor is usually classed as little above common labor, and the men paid accordingly, and the difference between good and bad hand firing is in the amount of physical labor expended and in the amount of knowledge and headwork used in doing it.

The question of the relative importance of labor and fuel costs is well worth considering, and the saving that can be effected by an increase of one pound of water evaporated per pound of coal will be

surprisingly great compared with the additional cost of labor necessary to keep an efficient and contented fire room force.

Mechanical stokers are rapidly taking the place of hand fired grates, in spite of their high cost, because they do, as a rule, give give better efficiency in daily operation.

It is doubtful if stoker installations effect much saving in boiler room labor unless coal is fed by gravity from storage to the stoker hopper. An average fireman can efficiently handle about 2,000 pounds of coal per hour, with hand-fired boilers, equivalent to 400 to 700 boiler horse power. A stoker fireman should be able to handle efficiently from 1,500 to 2,500-horse power and even as high as 3,000 horsepower of stokers, if he does not have to handle his coal and ashes.

It is claimed that stokers can be operated smokelessly, even at high overload, with all coals, provided they are set in properly designed furnaces. But it is also true that hand fired furnaces can be operated practically smokelessly with all coals except those containing more than 25 per cent. volatile. Smokeless operation is entirely a question of complete combustion of the volatile gases from the coal, at a temperature above the ignition point, which for carbon monoxide is about 1,200 degrees F., and it is, therefore, mainly a question of proper furnace design. The reason for obtaining more continuously smokeless combustion with stokers is that the coal is fed evenly and a small quantity at a time, the gases being distilled slowly.

(E) *Furnaces.*—Combustion is the chemical union of the combustible matter in a fuel with the oxygen of the air. Theoretically it is a simple process, being only necessary to bring each atom of combustible matter into contact with the proper quantity of oxygen to produce combustion to CO_2 and water vapor. Practically, it is impossible in any boiler furnace to bring about this intimate mixture, and in commercial boiler practice either insufficient air is supplied, and the combustible not completely burned, unburned CO and hydrocarbons escaping from the stack; or is a large excess of air supplied and part of the heat generated by combustion, instead of doing useful work, is lost in heating the excess air.

The best modern practice requires that the furnace be supplied with at least 50 per cent. more air than theoretically required for complete combustion, as losses due to excess air are, within limits, less than those due to incomplete combustion. The loss due to even a small percentage of CO will be realized when it is remembered that one pound of carbon burned to CO_2 gives 14,544 B.T.U.'s, and burning to CO it gives only 4,325 B.T.U.'s.

Perfect furnace operation with the theoretically correct amount of air would give flue gases containing over 20 per cent. CO_2 and no CO, but the best designed bituminous coal furnaces do not give over 15 per cent. CO_2 and seldom more than 12 per cent. continuously, with a trace of CO, and consequently are being supplied with between 50 and 100 per cent. excess air. The reasons for this apparently large excess amount of air are as follows:

(a) Difficulty in getting a uniform distribution of air to all parts of the fuel bed.

(b) Uneven distribution of fuel on the grate, and unequal resistance of different parts of the fuel bed to passage of air.

(c) Variable rates at which the gases from fresh coal are distilled, due to hand firing of fresh coal in varying quantities; or, with stokers, sliding of coal from hopper to grate. The supply of air being practically constant, a moderate excess at times when no gases are being given off, would be insufficient for complete combustion during coaling. Hence the necessity for excess air and the strongest argument in favor of coaling a fire light and often.

(d) The practical impossibility of providing any effective means of intimately mixing the gases and air above the fire. Many devices partly accomplish this, but the air and gas apparently have no strong affinity for each other and there is a tendency towards stratification.

It is impossible to evolve a furnace that will even approach theoretical perfection, but it should be the object of every engineer to design and operate furnaces to approach as nearly as possible to ideal conditions. Table No. 1 gives the loss due to excess air with different stack temperatures, and Table No. 2 the loss due to various percentages of CO for different percentages of CO_2 in the flue gases.

As seen from Table 1, it is impossible to prevent loss from heat carried away in the chimney gases, even if complete combustion with the theoretical amount of air could be obtained. In actual operation this loss can seldom be reduced below 15 per cent. and is usually 20 per cent. or more; but for any stack temperature the lower the excess air the less the loss. Stack temperatures usually depend more on the physical condition of the boiler and on the rate of steam production than on furnace conditions.

TABLE 1.—*Temperature of Chimney Gases. Degrees Fahrenheit.*

Pounds of air per pound of combustible.	300°	320°	400°	450°	500°	550°	600°	650°
12	750	905	1,060	1,116	1,370	1,528	1,683	1,840
*	5.2	6.5	7.3	8.7	9.5	10.5	11.6	12.7
15	865	1,112	1,305	1,498	1,679	1,880	2,072	2,262
	6.0	7.6	9.1	10.3	11.6	13.0	14.3	15.6
18	1,004	1,321	1,550	1,778	2,010	2,235	2,460	2,692
	7.2	9.1	10.7	12.2	13.9	15.4	17.0	17.9
21	1,266	1,530	1,785	2,060	2,320	2,582	2,846	3,118
	8.7	10.5	12.3	14.2	16.0	17.8	19.5	21.0
24	1,440	1,740	2,040	2,340	2,640	2,940	3,240	3,540
	9.9	12.0	14.0	16.1	18.2	20.3	22.4	24.4
27	1,611	1,950	2,281	2,620	2,958	3,291	3,628	3,962
	11.1	13.5	15.7	18.1	20.4	22.7	25.0	27.4
30	1,785	2,160	2,530	2,900	3,270	3,641	4,016	4,396
	12.4	14.9	17.4	20.0	22.6	25.0	27.8	30.4
33	1,957	2,362	2,779	3,180	3,589	4,000	4,405	4,820
	13.5	16.3	19.2	22.0	24.7	27.6	30.5	33.2
36	2,130	2,579	3,020	3,461	3,910	4,350	4,798	5,290
	14.7	17.8	20.8	23.9	27.0	30.0	33.0	36.6
39	2,300	2,781	3,261	3,743	4,220	4,700	5,180	5,670
	15.9	19.2	22.5	25.8	29.2	32.4	35.7	39.0
42	2,479	2,999	3,508	4,023	4,540	5,052	5,570	6,100
	17.1	20.6	24.7	27.7	31.3	34.8	39.4	42.0

* Theoretical requirement.

Upper figures in each double line give the loss in B.T.U.'s per pound of combustible; lower figures the per cent. loss, assuming a calorific value of 14,500 B.T.U.'s per pound of combustible.

TABLE 2.—*Per Cent. of CO_2 in the Flue Gas by Volume.*

Per cent. of CO in the flue gas by volume.	6.	8.	10.	12.	14.	16.
	328	248	199	168	144	126
0 2	2.2	1.7	1.3	1.1	1.0	0.8
	635	484	390	327	282	248
0.4	4.3	3.3	2.6	2.2	1.9	1.7
	925	709	575	474	417	367
0.6	6.3	4.8	3.9	3.2	2.8	2.5
	1,192	923	750	635	549	495
0.8	8.1	6.3	5.1	4.3	3.7	3.4
	1,494	1,128	923	780	676	596
1.0	10.2	7.7	6.3	5.3	4.6	4.1
	1,690	1,321	1,085	923	801	708
1.2	11.5	9.0	7.4	6.3	5.4	4.8
	1,920	1,512	1,248	1,061	924	819
1.4	13.1	10.3	8.5	7.2	6.3	5.6
	2,104	1,693	1,400	1,193	1,040	924
1.6	14.3	11.5	9.5	8.1	7.1	6.4
	2,340	1,865	1,549	1,321	1,151	1,025
1.8	16.0	12.7	10.5	9.0	7.8	7.0
	2,537	2,030	1,690	1,450	1,270	1,129
2.0	17.2	13.8	11.5	9.9	8.6	7.7

Upper figures in each double line give the loss in B.T.U.'s per pound of combustible, and lower figures the loss in per cent, assuming a calorific value of 14,500 B T.U.'s per pound of combustible.

Furnace Design.—An important question is that of the best design of furnace for the fuel available.

Considering the furnace as distinct from the boiler, grates and draught system, it is efficient when stack gas analyses show a continuous high percentage of CO_2, with maximum of CO. Flue gas analyses are the best tests of furnace efficiency, but low CO_2 or high CO is not always an indication of a poorly designed furnace. If flue gas analyses are to be depended on to determine the efficiency of furnace design, care must be taken to see that the following conditions are complied with.

(a) That samples taken represent the average of the stack gases. Samples should be taken from the last pass of the boiler and also from the first pass. A marked difference in the analyses of these two points will usually indicate air leakage in the setting.

(b) That samples are correctly analyzed, using solutions of the proper strength. This is especially important in determining CO_2 as it is absorbed with difficulty.

(c) That fire conditions are good, that coal is fed in small quantities and well spread, and that there are no holes in the fire. Heavy firing means high CO, and uneven fires excess air.

(d) That the brickwork of the setting is air-tight. This can usually be determined by testing with a candle flame, but some settings are

so thin and porous that they allow infiltration of air which cannot be detected. Such a condition can usually be discovered by taking samples from different points of the boiler, and can best be stopped by painting or cementing the settings.

(e) That the amount of air supplied to the fire is nearly correct. This will vary for different grades of coal and fire conditions, but can be determined by finding the differential pressure through the fuel bed, and making a gas analysis. By making a preliminary set of analyses and noting the differential pressure at the time the CO_2 in the gases is a maximum and the CO a minimum, the correct intensity of draught can be determined.

With hand firing, and bituminous coal, if an average of 10 per cent. of CO_2 with less than 0.5 of a per cent. of the CO can be maintained, and the stack gives off little black smoke, it can be assumed that the furnace is efficient for the fuel used.

Furnaces are usually inefficient because they do not provide sufficient space for complete combustion of the gases from the fuel before they are cooled below their ignition point, or because the gas passages are so short and direct that the air and gases are not intimately mixed.

The first fault can usually be remedied by:

(a) Lowering the grates to give more space between the fire and the tubes or shell of the boiler. This will involve changes in the boiler front and lowering the floor of the boiler room.

(b) Raising the boiler and allowing the grates to remain in their old position. This will accomplish the same results as lowering the grates, and is often the cheaper and better method.

(c) By installing a Dutch oven or extension furnace, wing wall, or other furnace that gives increased combustion space, and longer gas passages. Furnaces of this type are usually expensive to construct and to maintain, and are of doubtful value except for high volatile fuels, extensively used for small sizes of anthracite coal.

(d) By the installation of steam jets or other form of secondary air supply. Most of these devices are of doubtful value.

(e) In the case of return tubular and horizontally baffled water tube boilers, by the use of special baffle walls back of the bridge wall; or checker work arranged to break up the flow of gases and increase the combustion chamber temperature. Devices of this kind may prove effective, but usually burn out or fill up with soot after a few weeks operation.

(To be Continued.)

Extinguishing Fires In Volatile Liquids.

[Communicated by Mr. Frederic Egner.]

Referring to the article which appeared in Journal, dated the 26th ult., under the above heading, it may not be inappropriate to relate a few experiences with oil and gas fire extinguishing and preventing had by the writer. The following happening occurred 28 years ago, at the old works of the Laclede Gas Company, which works were at foot of Mullanphy street, St. Louis. We were making coal gas, enriched to the required illuminating power, by means of oil gas produced from 63° gas naphtha, which in those days was a cheaper medium for the purpose than cannel coal. All the gas manufactured at that time and place was produced in fireclay retorts, of the then common horizontal pattern. We had something like one oil gas retort to aid in each pair of benches of fives, the oil gas retorts being fed from a tank (4 feet diameter and 4 feet deep), standing on a platform fastened to the outside of the retort house wall, at a point high enough to give a good head or flow from tank to the retorts, or something like 28 feet above the yard level.

The tank was fitted with a wooden cover, which was only raised when oil was being pumped into it; this to permit the foreman, who alone did the pumping by means of a small steam pump, to note when the tank was nearly filled. The yard and coke cellar were on the same plane, all having been at one time the floor of a quarry. The oil tank was reached by means of a ladder placed on the platform around a nearby elevator, and the storage tanks were in a shed about 100 feet away.

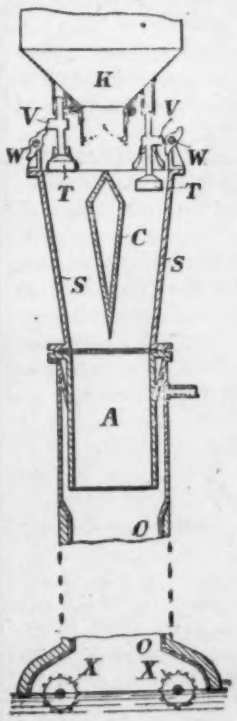
These storage tanks, of the cheese box type, were built gas tight, and were always under holder pressure, so a leak would have been quickly detected. These tanks, in addition to glass gauges similar to the water gauges used on boilers, were fitted with a light-weight, safety valve and a sensitive vacuum valve, so that, when oil was pumped from or into said tanks, should any stoppage in the gas pressure pipe from the holders take place, the valves would act to prevent collapse or a bursting strain. The tanks were alsolutely safe from danger of taking fire; but the small supply tank on the retort house wall was not. Although the contingency of danger was remote, it nevertheless came to pass.

One day one of our foremen (the late Michael J. Igoe), whose son is now a member of the 63d Congress, and on one of it's most important committees, while trying to do two things at once, let that little tank overflow. A "draw" was on at the time, and as some of the flowing oil got to the hot coke, we had a fine oil fire in about two seconds. I was not far away, and, hearing the shouting, ran to the spot and, seeing what was going on, stopped the men from sending out an alarm of fire or putting our own emergency hose at work. I climbed up to the burning tank, the ladder being fortunately on the windward side, and lowered the cover, thus promptly extinguishing the flames. Mr. Igoe was one of the worst scared men on the place, for he not only feared that I was about to be burned to death (he thought a good deal of me), but further expected to now be "fired" himself. However, such was not my intention, for not only did I know that the fire was not the result of wilful carelessness, but also that he was one of the best, most faithful, and capable men in the Company's employ. I merely cautioned him to look out next time. It never happened again.

"Once upon a time," while walking up Broadway, New York, I ran into a big fire in the then wholesale dry goods district. I had been a member of the fire department, having resigned only about 2 years before that date as a company commander, hence was well known to the Chief, his assistants and other officers, and most of the rank and file as well—I had been one of the three members of the Board of Examining Engineers of the Department. So I was always *persona grata* inside the fire lines. The building had been pretty well gutted, but in the basement was quite a blaze, which the Chief told me was the most stubborn thing he had yet encountered. Taking a good look over the situation, I found it was from the end of a 2-inch gas service that the spreading flame was issuing. Having become a gas man by that time and knowing what to do, I asked the Chief to let me put it out. He laughed, saying, "Go ahead 'Cap.' Let's see what you can do." I wet my handkerchief, had the streams of water turned aside, then slapped the handkerchief over the mouth of the pipe, and the fire was 'out.'"

New Methods and Appliances.

Stamped Charges for Verticals.—Patents have been taken by W. von Oswald, of Coblenz, Germany, on the continuous vertical retort shown diagramatically in the cut.



A metal feeder piece, *A*, is arranged on the top of the distillation chamber, *O*, corresponding in shape to the latter; the dimensions such that a space is left around the feeder to collect the gas, and from this space the gas is withdrawn. Above the feeder is a filler, *S*, "designed to meet the requirements of the method of filling which it is proposed to adopt." The fuel is supplied from a bunker, *K*, having doors at its lower end to control the rate of feeding. On the upper end of the filler is mechanism for operating stamping members, *T*. This consists of shafts *W* having cams adapted to engage on heads or rims, *V*, on the stampers. The cams raise the stamps, which then fall by gravity on to the fuel and "pack it to a uniform degree of tightness."

The filler is tapered, and as it is desired to introduce a tightly packed body of fuel into the feeder, it has a central tapered inset piece, *C*, extending from side to side. "This ensures the required degree of tightness of packing the fuel passing to the feeder."

The impacts of the stampers "cause a vibration to pass to the material in the distillation chamber, which facilitates its downward movement and prevents stoppage by caking or adhesion to the walls. Further, when a stoppage occurs, the stampers show it. The stoppage would cause a heaping of the coal beneath the stampers, so that these would remain in the raised position and signal that a stoppage has occurred."

The coke passes down the distillation chamber and is discharged in a sump or trough at the foot. At this point the movement of the coke is promoted by moving members, *X*, with projections or blades on their surfaces. The speed of rotation of the rolls is adjusted to suit the rate of sinkage of the coke; so that there is no pulling action on the coke—the rolls should just support and promote the natural movement. The rolls dip in the water of the sump to keep them cool.

GAS FOR BALLOONING.—In a recent issue of "*Het Gas*," Dr. Jorissen describes seven ways of making low specific gravity gas.

(1) *Von Oechelhäuser's.*—Ordinary coal gas run over coke in retorts at 1,200° to 1,400° C. The heavy hydrocarbons (2.6 per cent.), the carbonic acid (1.3), and the oxygen (0.2), disappear; the methane is reduced from 24.7 to 6.9 per cent., and the hydrogen, nitrogen and carbonic oxide, instead of 59.6, 6.3 and 5.3, become 80.7, 5.1 and 7.3 respectively (Dessau gas). The specific gravity becomes 0.225 to 0.30 instead of 0.41. A bench of ten verticals, 13 feet 3 inches high, made 127,714 cubic feet of balloon gas in 24 hours; six ordinary horizontals, made 42,378 cubic feet in 24 hours. Cost of treatment about 20 cents per 1,000 cubic feet of balloon gas made.

(2) *Rincker-Wolter Method.*—Overheating in the Rincker and Wolter process. Result, H 96.0, CO 2.7, N 1.3. The CO can be largely removed, leaving H 98.4, N 1.2 per cent. Cost of the balloon gas, 76 cents to $1.10 per 1,000 cubic feet.

(3) *Frank Caro-von Linde Method.*—Freezing the nitrogen, carbonic oxide and carbonic acid out of water gas. Result, 97 per cent. hydrogen. This may be further deprived of N and CO by being led over calcium carbide; result, 99 per cent. hydrogen. Cost of the first 54 to 67 cents; of the latter 74 to 87 cents per 1,000 cubic feet.

(4) *Merz-Weith Method*—Carbonic oxide led over slaked lime ($CaH_2O_2 + CO = CaCO_3 + H_2$) at 450° to 500° C. Water gas is used, accompanied by steam in order to prevent the reaction $CaO + 2CO = CaCO_3 + C_2$. Iron (5 per cent.) accelerates the reaction. Cost of the gas made, 54 to 67 cents per 1,000 cubic feet.

(5) *Coutelle* (Giffard, Strache, Lane, International Hydrogen Company).—Iron oxide reduced by water gas to iron; at 800° to 900° C.; regenerated by its action on steam, producing hydrogen. The water gas used has its heating value but little impaired, and is used in the general gas supply. The company named supplies units of a capacity of from 5,300 to 5,650 cubic feet of 98½ per cent. hydrogen per hour.

(6) *Bergius.*—Liquid water and iron at 300° to 340° C.; ferric chloride and copper used as accelerators. Result, 99½ per cent. hydrogen, in cylinders.

(7) *Electrolytic Methods.*—Decomposition of water. The specific gravity of pure hydrogen is 0.070, that of factory hydrogen from 0.077 to 0.100, that of ordinary coal gas from 0.35 to 0.52, and that of blue water gas about 0.50.

ORNAMENTAL POST USED IN MEMPHIS.—Boulevard gas lamps, like the illustration, have been installed by the City of Memphis, Tenn., on Peabody and McLemore avenues, a part of McLean boulevard and Snowden Circle, and it is probable that they will be installed at an early date on Central avenue. The lights are turned on and off automatically by clockwork, the effect of which is to greatly reduce the cost of maintenance.

The attractive glass signs, combined with the lamps on Peabody avenue, are coming in for much favorable comment from citizens living in that section of the city. The advantage of these signs lies in the fact that they are as plainly visible at night as in the day time.

SUN-POWER PLANT.—Tests on the sun power plant at Meadi, near Cairo, Egypt, which has a sunshine collecting surface of 13,000 square feet, heating five boilers, have shown an average of 1,170 pounds of steam generated per hour, the pressure varying from 1.1 pound to 1 pound per square inch above atmosphere. A maximum output of 1,442 pounds of steam per hour was obtained about noon August 22, 1913. The experiments were conducted under favorable weather conditions, the average shade temperature being 95.5° F. and the mean humidity 35 per cent. The computed maximum steam production per square foot of sunshine-collecting area was 0.12 pound per hour. A steam engine, especially designed to operate on pressures of 1 pound per square inch, consumes 22 pounds per brake horse power hour when carrying a load of 97.5-horse power. If use had been made of nine boilers instead of five, it is believed that the engine could have been operated for 12½ hours a day with a load of 95 brake horse power.

SAFETY DEVICE FOR CALORIMETERS.—The American Meter Company, New York, has just brought out a simple, altogether dependable safety device to be used in connection with the operation of its well-known calorimeter. The device consists of an automatically acting valve, which shuts off the supply of gas should the water supply to the calorimeter be temporarily discontinued for any cause whatever. This prevents the burning-out of the calorimeter. The Company will be pleased, upon request, to furnish any further particulars respecting this device and its application.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. WILLIAM D. CLIFFORD, formerly a resident of Westfield, Mass., but for 6 years located in Manila, P. I., has just been elected Secretary of the Manila Gas and Electric Company.

THIS is from the New Haven, Conn., *Journal*, dated the 10th inst.: "At the annual meeting, yesterday, of the New Haven Gas Light Company, all officers were re-elected, as follows: Directors, H. S. Hotchkiss, Eli Whitney, F. F. Brewster, Jas. T. Moran, J. S. Hemingway, Charles H. Nettleton, A. H. Robinson, W. J. Trowbridge, and George D. Watrous; President, C. H. Nettleton; Treasurer and Secretary, J. Arnold Norcross; Engineer and Superintendent, Robert E. Wyant. President Nettleton told the shareholders of the growth the Company is experiencing, and of the necessity of building additions to the plant to keep pace with the development of the gas business. He told of the work that had been started in connection with the new vertical retort system, which it was estimated would involve an expenditure of $350,000. In the new retort house plant, which is an extension of the existing generating system in buildings on East Chapel street, the gas will be made wholly from coal. He explained that the Company was forced to follow this plan because the oil companies had largely increased the cost of their product which was used in great quantities as an enriching agent. Besides the increased generating facilities, President Nettleton called attention to another new structure underway that was intended to facilitate the operating of the mains and service department. This structure, which is of modern style concrete construction, is on Mill street, not far from the main plant. It was also explained that a tar and benzol recovery plant had been installed in the year." This presentation, together with the knowledge that the year had been a signally prosperous one all-round in the workings of the corporation, resulted in the re-election (as told above) of the executives whose united effort brought about this satisfactory and praiseworthy state of affairs.

AT the annual meeting of the Salem (Mass.) Gas Light Company the following Directors were elected: Henry A. Hale, Sydney W. Winslow, Andrew W. Rogers, Jno. H. Smith and Charles R. Prichard—the latter is a son of the late Mr. Charles F. Prichard.

THE annual reports of the Georgetown (D. C.) Gas Light Company show that the Company's position is an excellent one. The output (paid for) amounted to 153 million cubic feet, disposed of at an average price of 99 cents per 1,000. The net receipts were (gas and by-products) $99,169.19; labor charges amounted to $33,059, and the materials account and maintenance accounts absorbed $55,862.05. Interest and dividends absorbed $30,106.10. The Company has 2,470 separate shareholders.

MR. J. G. MELSON and associates have advised the City Council, of Mason City, Ia., of their desire to withdraw their petition calling for a special election of the residents in respect of an application to the Council to construct and operate an opposition gas plant in Mason City. Mr. Melson declares that his purpose to journey to England, there to make a visit with certain of his relations, is the impelling cause of the withdrawal. It that the real reason, Mr. Melson?

MR. C. A. ERWIN and associates, of Winters, Yalo County, Cal., are proposing to establish a gas plant in Rio Vista, Solano County, Cal. The named place is a post town of Solano County, on the west

bank of the Sacramento river, about 65 miles east, northeast of San Francisco. It is noted for its fruit packing establishments, and the average wealth per inhabitant (of whom there are 2,200) is somewhat remarkable.

"THE people of Wilson, N. C., seem doomed to disappointment in respect of the granting of a franchise for the operation there of a gas works. The terms of the proposed franchise had been carefully examined, both by special committees of Council and of the Chamber of Commerce, and it was taken for granted that the order for a special election would issue. The Council, however, at its last meeting, by a vote of 3 to 2, deferred action until the second week in March.—V. R."

ARCHITECT F. L. Packard, having completed the necessary plans and specifications, has asked for bids for constructing the proposed new office building for the Delaware (Ohio) Gas Company.

WE are informed that, through the action of Prof. George A. Hoadley, Dean of the Engineering Department, Swarthmore (Pa.) College, an illustrated lecture on accident prevention was recently delivered in Swarthmore Hall, by Mr. J. B. Douglas, of the United Gas Improvement Company. To mention the name of the lecturer is a guarantee that the subject was well and ably presented.

THE plant of the Key West (Fla.) Gas Company, which was put actively in commission June 18th, 1912, has been so successful that the proprietors are seriously thinking of making additions thereto this spring Over 2,500 gas ranges have been booked-up, and during 1913 several hundred additional meters were set. The distributing system covers 38 miles of run, and no service less than 1¼-inch has been connected. The active staff of the Company is thus returned: Manager, S. P. Vecker; Supt. Distribution, J. W. Wilson; Superintendent of Plant, G. E. Spielman; Chief Salesman, L. B. Lovell; Cashier, H. A. Virchow.

AT the meeting of the Board of Directors, the Washington (D. C.) Gas Light Company, the following executive management was named: President, Howard S. Reeside—succeeding Joseph Leiter; Treasurer, Lawrence Townsend; Secretary, W. B. Orme; Auditor, Sanford Whitwell; Assistant Treasurer, Rollins Hume; Assistant Secretary, George Whitwell; General Counsel, J. J. Darlington; Attorney, Benjamin S. Minor. An astounding feature of the proceedings was the tendering of his resignation, as General Manager, by Mr. Peter Young. The naming of a successor to Mr. Young was deferred until a future meeting, the next of which is set for the 5th prox.

"ABOUT as completely surprised a man as could be imagined was Mr. C. C. Atwood, for quite a while the competent, well-liked Superintendent of Manufacture, New Amsterdam works, the Consolidated Gas Company, with headquarters in Ravenswood, Long Island. Having one-way-or-another learned that Mr. Atwood was proposing to resign from the New Amsterdam staff, to join with his brother (George D. Atwood) in the metropolitan representation of the Kerr Turbine Company, his 'boys' thought it fitting that their well-liked head should have something to remember them by, got together and purchased a handsome specimen of a Victor Victrola. At an appropriate time Mr. C. H. Stevick managed to inveigle Mr. Atwood to the meter room of the Ravenswood station, and there, in the midst of of his men, the presentation was duly made, the speechmaker being Mr. Stevick. Atwood is, at best, not much of a speaker, but, under the circumstances, he was out-of-voice altogether. However, in the acceptance that he did manage to utter, everyone of his fellows knew that their comrade was fully alive to the thought that prompted their action. Mr. Stevick succeeds Mr. Atwood in the New Amsterdam position.—M. J. M."

"C. F. M., writing from Phoenix, Ariz., under recent date, says: "I am pleased to say that a compromise has been agreed to, between the Arizona Corporation Commission and the Pacific Gas and Electric Company, of Phoenix, under which (as of February 1st) a 30 per cent. cut on electric current service, and 25 per cent. in gas rates became effective. The Commission admits that the Company is entitled to earn an 8 per cent. per annum return on its officially appraised physical valuation; further, the Company agrees to immediately set aside $100,000 for extensions to its systems."

THE Carolina Power and Light Company announces that it has acquired the property heretofore occupied by the Peoples Laundry concern, on the line of the Southern Railway, between Boylan Heights and the freight depot, to Cabarrus street, at Raleigh, N. C., and will construct thereon a model plant of the coal gas type. It is estimated that, under the scheme proposed, an expenditure of $100,000 will be necessary. The President of the Company is Mr. Charles E. Johnson.

THE H. M. Byllesby & Company corporation reports, under date of the 11th inst., that, during the fiscal year ended November 30th last, its subsidiaries (including patrons of its gas, electric light and power, telephone, steam heat and water plants) showed a total of 215,768 customers, as compared with a total of 195,747, at like date of 1912—or a percentage gain of 10.2.

THE Northern Connecticut Light and Power Company has retained Miss H. W. Jones in the capacity of visiting demonstrator to instruct the people in their homes as to the best ways and means of using gas on any and all accounts.

MR. ALBERT SILVA, Secy.-Treas., the Union Light, Heat and Power Company, of Cincinnati, declares that if those interested in the project to have gas laid on in South Covington, Ky., can secure 750 signatures in the named district to a pledged use of gas, the work of piping will be commenced this spring. It is estimated that the cost of piping South Covington in any fairly complete way will amount to $50,000.

"THAT the suppliers of natural gas, in the untrameled State of Oklahoma, are not without tramels, would seem to be shown from the following edict at the instance of an order, recently signed by Commissioners 'Jack.' Love and G. A. Henshaw, having to do with the supply of gas to Collinsville," so writes a correspondent in Oklahoma City. The conditions are appended: "It is ordered that the Collinsville Gas Company, successor to the Robert L. Henry Gas Company, shall furnish gas for lighting and heating all public school and municipal buildings in the city of Collinsville, without charge during the life of the franchise; that the defendant Company shall lay all service pipes to the curb line of the street, without any charge to the consumer for tapping mains; that the defendant shall furnish an adequate supply of gas, and if, from any cause, an adequate supply to all cannot be maintained, domestic consumption shall have the preference, and manufacturing industries may be shut off if necessary to supply the domestic consumers. This will not apply to the Collinsville Meter and Light Company, unless it shall have had reasonable notice to secure other fuel; that the defendant may require a deposit for domestic consumers of not to exceed $5, and for hotels and restaurants of $10, upon which deposits it shall pay not less than 5 per cent. per annum."

ARTHUR B. PROAL, who will be remembered from his connection with the old Chesapeake Gas Company and other free lance gas companies of the past (notably those in which the then Commodore Benedict was concerned), died at his home, the Navarre Apartments, New York, the night of the 3d inst. He was in his 71st year, having been born in Utica, N. Y., July, 21, 1843. At the time of his death he was President of the Union Carbide Company, and a Director in the Bridgeport (Conn.) Gas Company, besides being officially connected with a dozen or more other industrial concerns. It might also be said that at one time he was actively engaged in the long-drawn out contest that resulted in the downfall of the original Indianapolis (Ind.) Gas Company. His wife survives him; also, two sons and a daughter.

MESSRS. CLAWSON BACHMAN and Joseph T. Hayden have applied for letters underlying the formation of the Chester City Gas Company, of Chester, S. C. The petitioners assert their belief that $300,000 capital stock will be sufficient for the purpose in view, and we submit that no one will take exception to that assertion. Yes; $300,000 should be ample, if not more than ample.

IN reporting recently the results of the annual meeting of the Detroit City (Mich.) Gas Company, the returns were a trifle mis-stated. An accurate reporting thereof is as follows: Directors, I. Butterworth, Homer Warren, Emerson McMillin, V. F. Dewey, G. H. Russell, Geo. E. Lawson, Frank P. Byrne, H. E. Bodman and A. P. Ewing; President, E. McMillin; First Vice-President and General Manager, V. F. Dewey; Second Vice-President, Irving Butterworth; Treas. and Secy., Charles S. Ritter; Auditor, H. W. Sheriffs; Assistant General Manager, A. P. Ewing; Asst. Treas., J. M. Wright; Asst. Secy., C. W. Jellife; Consulting Engineer, H. C. Abell; Asst. Auditor, J. Lowerence.

Utilities Commission News.

PENNSYLVANIA APPOINTMENTS.—Mr. A. B. Millar, of Philadelphia has been appointed secretary of the Pennsylvania Public Utilities Commission which took authority January 1.

Mr. Millar is well and favorably known throughout the State, having been Secretary to Edwin S. Stuart during his term as Governor, and succeeded H. S. Calvert as Secretary of the old State-Railroad Commission.

W. N. Trinkle, former deputy attorney general, was appointed counsel to the Commission, and B.H. Evans, Pittsburgh, as assistant. John P. Dohoney, of Harrisburg, was elected investigator of accidents, and George Woods, Philadelphia, marshal.

ILLINOIS OFFICIALS.—The five members of the new State Public Service Utilities Commission of Illinois have been appointed by Governor Dunne. James E. Quan, of Chicago, the chairman, is a personal friend of the Governor and has been in the wholesale grocery business. This is his first public office. He is a Democrat. Richard Yates, of Springfield, lawyer, was Governor of Illinois from 1901 to 1905. He is a Republican. Frank H. Funk, of Bloomington, was formerly State Senator, and was the Progressive candidate for Governor in 1912. Walter A. Shaw, of Chicago, is a civil engineer, member of the Western Society of Engineers and the American Waterworks Association. He has been a member of the Rivers and Lakes Commission of the State, and President of the American Engineering and Constructing Company of Chicago. He is a Democrat. Owen P. Thompson, of Jacksonville, is a lawyer, and resigned as Presiding Justice of the Fourth Appellate District of the State to accept appointment on the Board. He is a Democrat.

The Commission will have headquarters in Springfield, and an office in Chicago, dividing its time between the two cities.

THREATEN MUNICIPAL PLANT.—The Maryland Public Service Commission has resumed the hearing on the petition of the Mayor and City Council, of Easton, asking that the Easton Light and Fuel Company improve its plant and reduce rates. Testimony was presented in regard to the general condition of the plant and its ability to furnish gas and electricity. Mayor Higgins, of Easton, stated to the Commission that a bill had been introduced in the Legislature giving Easton the right to erect a municipal electric plant.

TO REGULATE MUNICIPAL PLANTS.—Owing to the fact that the Michigan State Railroad Commission has no authority to regulate the rates of municipally owned lighting plants, it is predicted that a bill will be introduced at the next session of the legislature that will give the Railroad Commission greater power over institutions of this kind.

The State law regulating private corporations of a public utility nature are stringent, but there is no safeguard in case a municipal plant charges an exorbitant rate, and in case the consumer fancies he has a grievance, he has no one to whom he can tell his troubles.

SPECIFED ACCOUNTS FOR MUNICIPAL PLANT.—"A public utility plant owned by a city should be treated as an enterprise separate and distinct from the city itself All its accounts should be kept accordingly, and in every respect the plant should be deemed an independent agency."

This is the conclusion of the Railroad Commission of Wisconsin in a recent case involving the rates of a municipally owned water utility. Wisconsin is one of the few States in which utilities owned by municipalities are regulated by the State Commission exactly as privately owned utilities. In this case the city of Sparta applied to the Commission for authority to increase and readjust its water rates. The case was decided September 13, 1913, the Commission ruling:

1. The city must pay the utility at a reasonable rate for all service rendered the city.
2. The utility must pay the city a reasonable amount of taxes and as interest on the city's equity in the property.
3. The city must provide all funds for capital expenditures, such as new extensions, retirement of bonds, etc.

The Market FOR GAS SECURITIES.

Consolidated was dull and strong in the interim, the opening to-day (Friday) being reported at 134¼ to 135. The severe weather conditions have interfered somewhat with works' operations at Astoria, but the Ravenswood station was up to the drive. The output, too, during the fortnight was simply astonishing. Brooklyn Union is showing quite some strength. In connection with the electric division of the Company's trading we cannot forbear quoting this, from the Dow-Jones Circular of yesterday: "The New York Edison Company, the largest Company in the Consolidated Gas Company's electrical division, in January, failed to maintain the gain in business achieved in January, 1913. Its gain in sales amounted to a *mere* 7 or 8 per cent., contrasted with more than 12 per cent. a year ago." The italic is ours. A little later down is the statement that, in 1912, the New York Edison earned $21,024,941. Just a mere trifle—7 per cent. advance on 21 millions. Wonder what the Dow folks would call a bagatelle?

The shareholders in the Worcester (Mass.) Gas Light Company have authorized a new issue of 2,000 shares, at $200 per share, payment to be made on or before April 15th.

The gross income (1913) of the Peoples Company, of Chicago, amounted to $16,825,534, as against $16,730,936 in 1912,. The balance applicable for dividends in 1913 equaled 8.25 per cent. on the capital.

The Wilmington (Del.) Gas Company has declared its regular semi-annual of 3 on the preferred, payable the 2d prox. Treasurer Townsend announces that the quarterly of 1¾ on the common of the American Gas Company is payable the 2d prox. Messrs. N. W. Halsey & Co., of New York, have purchased $2,500,000 of the Laclede 5 per cent. notes, at a discount of 5¼.

We understand that the Washington (D.C.) Company has finally succeeded in purchasing the 2,470 shares of the Georgetown (D. C.) Company, the price being returned at $155 on each $100 par. This means that in short order the two companies will come together. Legislation, however, will be required to permit this ending. A notable thing in connection with the operation by the Byllesby corporation of the Louisville (Ky.) artificial lighting properties is that, in the special campaign for industrial fuel gas, contracts concerning the annual use of 264 millions cubic feet have been signed. The market for gas bonds continues active; in fact, the bargain counters of the bond houses are quite bare of these securities. Peoples (Chicago) registered fives are 100¼ bid.

GAS STOCKS.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

FEBRUARY 23.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	134¼	135
Central Union Gas Co. —				
1st 5's, due 1927, J. & J.	8,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	101	104
Mutual Gas Co.	3,500,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	96	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	127	127½
1st Con. 5's, due 1948, M. & N.	15,000,000	—	102	103
Yonkers	999,650	500	180	—

Out-of-Town Companies.				
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Chicago Gas Co. Guaranteed				
Gold Bonds	7,660,000	1,000	104	106¼
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Cincinnati Gas and Electric Co.	29,500,000	100	67	69
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus Gas Light & Fuel				
Company	1,682,750	100	65¾	66¼
Preferred	3,026,500	100	33	35¾
Detroit Gas Co., 5's	381,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100¼
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,850,000	1,000	100	101
Hartford	750,000	25	190	200
Laclede Gas Co., St. Louis.	10,000,000	100	97	101
Preferred	2,500,000	100	—	102¼
Bonds	10,000,000	1,000	103¼	103
Massachusetts Gas Companies, of Boston	35,000,000	100	94	94¼
Preferred	25,000,000	100	93	93¼
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	108	
Montreal L. H.& P., Canada	9,000,000	100	229	230
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	121¾	122
1st Mortgage	20,100,000	1,000	103	103½
2d "	2,500,000	1,000	104	—
Pacific Gas and Electric Co.	15,500,000	—	45½	45¾
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	113¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
United Gas Imp. Co.	55,502,950	50	171	172
Washington (D. C.) Gas Co.	1,600,000	200	440	447
Western Gas Co., Milwaukee	4,000,000	=	=	=